PUBLISHED FOR THE PHYSICIAN

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Diabetes Mellitus

modern concepts and treatment

from the
Lilly Research Laboratories

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published for the medical profession
by Eli Lilly and Company
Indianapolis 6, Indiana, U.S A.

INSULIN, LILLY, PREPARATIONS

short action

prolonged action

INSULIN, LILLY

Insulin, a product discovered and developed at the University of Toronto, is an aqueous solution of the active antidiabetic principle of the pancreas

INSULIN, LILLY,
MADE FROM ZINC-INSULIN CRYSTALS

is a solution of a crystalline preparation of the antidiabetic hormone Zinc-Insulin crystals are typical of the only forms in which the active principle has been prepared in a chemically pure, crystalline state

NPH INSULIN, LILLY,

is a new modification of Insulin having improved characteristics of time-action It contains protamine in chemical combination with Insulin, in isophane ratio best suited to form crystals of Insulin, protamine, and zinc which are of high purity

PROTAMINE ZINC INSULIN, LILLY,

designates that preparation of the antidiabetic principle which has been modified by the addition of protamine and zinc Protamine Zinc Insulin provides a blood-sugar-lowering effect lasting from twenty-four to forty-eight hours

foreword

THE FIRST FEW YEARS of Insulin therapy were of necessity occupied with learning how to employ the new discovery of Banting and Best with the drastically restricted diets in use at that time During later years, however, there has been a widespread adoption of diets which contain more liberal amounts of carbohydrate and less fat As a result, the diabetic diet of today does not differ materially in palatability and should not differ in nutritional adequacy from the diet of the normal person

The development of Protamine Insulin by Hagedorn and his associates and the investigation by the Toronto observers of the important role of zinc in modified preparations of Insulin signified other advances in the therapy of diabetes The fact that a single injection of Protamine Zinc Insulin can be effective over the entire day and night justifies the hope that the diabetic patient may now be maintained not only more comfortably but with less tendency to develop complications characteristic of diabetes which has been only partially controlled That this hope is being realized is borne out by recent statistics showing added longevity in patients treated with Protamine Zinc Insulin since 1936

More recent investigations have led to the development of another modified Insulin preparation whose timing of action more nearly meets the daily variations in the metabolic load NPH Insulin has been deliberately developed and chosen from a large series of preparations because of its distinctive intermediate action between the effects of unmodified Insulin and Protamine Zinc Insulin Its more rapid onset of action usually provides adequate control of the after-breakfast rise in blood sugar which formerly necessitated separate supplementary doses of unmodified Insulin, yet its duration of effect is sufficiently prolonged to protect against activation of the diabetic process in the course of the night with consequent elevation of the blood-sugar level during the fasting phase on the following day

These advances have necessitated four revisions of this book The sections on treatment with Insulin preparations and on diet have been revised in keeping with modern trends The published works of many investigators have been freely consulted, but individual references to published work have in the main been omitted, owing to the vast bibliography now available Several hundred reports have [illegible]

test of time

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SECTION 1

Basic Principles

THE ubiquity of diabetes necessitates a reasonable familiarity with its management, not only by the physician particularly interested in metabolic conditions, but also by the surgeon, by workers in other special fields, and particularly by the general practitioner

The imperative need for Insulin by every patient with severe diabetes and by practically all diabetic children is now generally recognized The safe, economic, and rational use of Insulin depends upon the establishment of an equilibrium between food requirements and the dose of Insulin, and this mode of treatment rests squarely upon fundamental and simple dietetic principles

Furthermore, it is desirable that every patient with diabetes, whether mild or severe, have sufficient knowledge of the benefits of Insulin that he may, through instructions given by his physician, recognize without delay the urgent necessity for its use should his carbohydrate tolerance suddenly become further impaired by infection, surgery, trauma, or other factors "Other things being equal," one authority states, "the diabetic who knows the most lives the longest"

DEFINITION OF DIABETES

Diabetes mellitus is a hereditary disease characterized by impairment of the body's normal ability to metabolize or utilize food This defect is manifested by increased amounts of sugar in the blood and subsequently by the excretion of sugar into the urine The abnormality is largely dependent upon an actual or relative deficiency of insulin resulting from a disturbance in the function of the islands of Langerhans of the pancreas or interference with the action of insulin in the tissues, it involves faulty storage of sugar in the liver, the overproduction of sugar in the liver, and possibly a diminished utilization of sugar by the tissues Insulin not only promotes normal combustion of dextrose in the tissues, but influences the metabolism of protein and fat

PHYSIOLOGY OF NORMAL AND DIABETIC METABOLISM

A thorough acquaintance with the physiological principles underlying normal metabolism is a prerequisite to understanding the derangements characteristic of

diabetes Although recognized for centuries, only in the last thirty years has the true nature of the disease become known Diabetes affects profoundly all the chemical interchanges taking place in the body cells as they deal with the various energy-supplying foodstuffs necessary for their existence, and although the disease is primarily a disturbance of carbohydrate metabolism, other systems are affected as well

FUNCTION OF FOOD IN HEALTH

Man's body, like an engine, requires fuel, or energy, which must be derived from his food The essential elements of food which furnish energy and heat are carbohydrate, protein, and fat (Table I) Water, mineral salts, and vitamins are just as indispensable for the maintenance of normal nutrition, but they do not enter directly into the energy exchanges of the body The carbohydrate portion of the diet is taken in the form of starch, such as potatoes and other vegetables, bread, pastry, macaroni, and sugar The sources of protein are largely lean meat and eggs, and fat is supplied in butter, cream, salad oil, and fat meat Many foods contain all three classes of foodstuffs, but there is usually a preponderance of one which serves as a basis for classification Although all supply energy and serve to "heat and run the body," each one behaves in a more or less characteristic manner and has its

TABLE I • *Normal Daily Requirements*

ENERGY PRODUCING FOODS (25 to 70 cal per Kg)*	(a) CARBOHYDRATES (200 to 400 Gm) (40%)	Glucose is the fuel of life The diet must supply enough to maintain normal stores in liver and muscle Carbohydrate provides glycogen to protect the liver
	(b) PROTEINS (1 to 3 Gm per Kg)* (15%)	Provide enough to maintain nitrogen balance and permit normal growth and repair of tissues Average 1 Gm per Kg of body weight (adult)
	(c) FATS (60 to 125 Gm) (45%)	Fats serve primarily as reserve and secondarily as available fuel The optimum requirement has not been definitely determined The normal daily requirement is about *100 Gm*

*High values for young active persons. Low values for old, sedentary patients.

own peculiar functions For example, carbohydrate is especially *useful because it* so promptly supplies energy for muscular work and since, in addition, its oxidation exerts some regulatory effect upon the metabolism of fat Thus, impaired consumption of carbohydrate, as in diabetes, deranges *fat metabolism* in such a

manner that toxic by products (ketones) are found in large quantities in the liver and produce ketosis (the diabetic type of acidosis) and finally diabetic coma

Carbohydrate—The far reaching importance of carbohydrate metabolism is apparent from the fact that dextrose is the primary sugar into which carbohydrates are converted before they can be utilized by the animal body Dextrose is the most readily available source of energy for the body and in the diet normally supplies approximately forty percent of the total energy required The different steps involved in the transformation of dextrose into glycogen and its storage in the liver are complex but the decreased deposition of glycogen from glucose under the influence of Insulin is the most firmly established physiological action of the hormone Muscle glycogen is not directly a source of blood sugar although it may serve the purpose indirectly through its conversion into lactic acid which can be utilized by the liver as a source of hepatic glycogen

In the production of energy dextrose may be broken down in two ways by the anaerobic or glycolytic process and by the aerobic or oxidative route The various steps in conversion are accomplished through the catalytic action of enzymes which in turn are activated by their coenzymes The steps from glycogen to pyruvic acid can occur in the absence of oxygen If there is an impairment in oxygen supply or an excessively rapid rate of glycogen breakdown pyruvic acid tends to accumulate and is rapidly converted to lactic acid which again may be converted to glycogen by the liver (see Vitamins page 74)

Protein—Protein is characterized by its content of nitrogen It usually contains sulfur and sometimes phosphorus Its units are amino acids and these building stones represent the end products of protein digestion which may be reassembled by the body to provide new forms of protein essential to the animal The incombustible amino (NH_2) group is removed by the liver and then excreted as urea, whereas the carbohydrate remainder may be oxidized to produce energy In this manner about 58 percent of the protein in the body may become available to the organism as sugar Protein also exerts a stimulatory effect upon metabolism a specific dynamic action which makes the use of too-large quantities of this foodstuff undesirable especially in diabetes Approximately 15 percent of the total calories are supplied by dietary protein

Fat—Fat is a more concentrated source of energy than either carbohydrate or protein and yields about twice as many calories per gram Consequently, fat can be employed to increase the caloric value of a diet without substantially increasing its

bulk A special function of fat is its contribution to the supply of body fat, whicl constitutes a reserve source of energy

Minerals and Vitamins—No discussion of metabolism would be complete without some mention of the minerals and vitamins which are so essential to the maintenance of body health and vigor They are frequently called accessory food factors and a number of the vitamins, particularly thiamin, riboflavin, and nicotinic acid, have been shown to be intimately concerned in the systems governing the oxidation of carbohydrates, proteins, and fats Of the B group of vitamins, vitamin B_1 (thiamin) apparently influences the rate of conversion of carbohydrate to fat and ap-

and amino acid metabolism Nicotinic acid appears to function mainly in protein and carbohydrate metabolism by transporting hydrogen Nicotinic acid deficiency causes water retention Under certain conditions in which carbohydrate metabolism is being forced by administration of Insulin and large quantities of dextrose, the available supplies of these vitamins may be rapidly used up if they are not continually replaced, with a resultant acute deficiency—an occurrence not uncommonly encountered in the past following intensive treatment of diabetic coma

TABLE II • *Minerals and Vitamins*

An adequate supply is provided by including in the diet daily

1 pint of milk	4 servings whole grain bread or cereal
1 egg	2 servings vegetable other than potato (1 raw)
1 serving (90 to 120 Gm) meat	
3 teaspoonfuls (15 Gm) butter	2 servings fruit (1 raw)

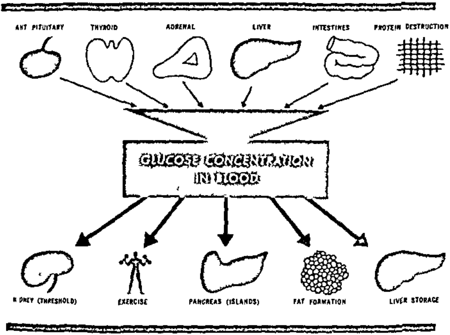
These quantities in themselves will provide approximately 1,200 calories Any diet containing less than these amounts of protective foods obviously should be fortified with vitamin supplements

shown in Table II If for any reason the daily intake falls below amounts, vitamin and mineral supplements will be necessary in order to protect the patient from developing a deficiency

BLOOD-SUGAR LEVEL

The blood sugar level of a normal person in a fasting condition is remarkably constant, averaging about 100 mg per 100 cc of blood, with individual variations ranging between 70 and 120 mg per 100 cc The blood-sugar level ependent

FIGURE 1—*Factors Influencing the Level of Blood Sugar*



upon a delicately balanced equilibrium between the constantly opposing forces of dextrose supply from the liver and the utilization or combustion of sugar by the tissues It is essential, from the standpoint of diagnosis as well as treatment, to realize that the blood-sugar level at any given time represents the resultant of a complex, interacting adjustment involving, among other things, the action of insulin on the one hand, opposed by factors from the pituitary, adrenal, and thyroid glands, and possibly the influence of associated nerve centers in the hypothalamus and pons. Consideration of this mechanism will make misinterpretation of an ab-

Diabetes Mellitus

The entire circulating blood contains only about five grams of sugar Following digestion, carbohydrate foodstuffs are carried to the liver, where the dextrose can be converted into glycogen and stored Then, as required for body needs glycogen is reconverted into dextrose and passed back to the blood stream This regulation is automatic and adjusted so that the percentage of sugar in the normal blood ranges between 0 08 and 0 15 percent (80 to 150 mg per 100 cc of blood) The lower levels are ordinarily observed before breakfast and the higher levels from thirty to forty five minutes after meals In the normal individual, although the fasting levels are the same in arterial and venous blood, after a meal the arterial blood sugar level is 20 to 50 mg or more higher than that found in venous blood This is particularly important when capillary blood, obtained by finger prick, is employed for testing, and some observers have utilized the arteriovenous difference as an aid in diagnosis, since it indicates the extent of utilization of carbohydrate by the tissues

In a normal person, the level of blood sugar rises following food but falls to normal within two hours In the diabetic, the percentage of blood sugar varies more widely, depending upon the severity of the disease, previous treatment, and complicating factors Thus it may be barely 140 in the postabsorptive state, although in severe diabetes, particularly in children, even the fasting level may be 300 or more Occasionally, the fasting blood sugar remains normal in amount for a considerable time after development of diabetes

METABOLISM IN DIABETES

All the complicated steps in the conversion of foodstuffs into energy are brought about by the various enzymes or ferments of the body, and these appear to be controlled or activated through the secretion of insulin by the pancreas It has been generally conceded that insulin production and the blood-sugar level are interdependent, but under certain circumstances, insulin production may appear to be inadequate, with the result that the liver fails in its glycogenic function and utilization of sugar at normal levels by the tissues is inhibited The accumulation in the blood of dextrose which can be neither stored nor burned at normal levels is accompanied by glycosuria, with a succeeding train of symptoms which are characteristic of the diabetic syndrome

KETOSIS

In the absence of sugar utilization, the metabolism of fats and proteins is accentuated to meet the energy requirements of the body, and there is increased production of ketones by the liver for distribution to the tissues for complete combustion The actual production of ketones may be subject to regulation by the glycogen

level in the liver itself When the rate of ketogenesis in the liver exceeds the rate of oxidation of ketones in the tissues ketonemia and ketonuria ensue and the excess is excreted in the urine as acetone and diacetic acid Thus ketogenesis indicates either a relative or absolute shortage of carbohydrate for fuel

Some of the ketones are excreted as free acid other portions are neutralized by increased ammonia production and by the buffer action of the blood by which carbon d oxide is displaced from the bicarbonate of the plasma Fixed base chiefly sodium is lost when the ketosis is severe and dehydration and hemoconcentration occur Compensatory mechanisms are overwhelmed and several outstanding al terations from normal gradually appear (1) The carbon dioxide combin ng power of the blood is reduced in proportion to the severity of the acidosis (2) continued loss of fixed base accentuated by vomiting entails a reduction in sodium chloride and electrolyte concentration lowered alkali reserve diuresis and dehydration (3) acetone and diacetic acid appear in the urine in large quantities (4) hemocon centration develops (5) the *p*H of the blood shifts toward the acid side (6) Kuss maul breathing (air hunger) ensues and the blood pressure falls followed by circulatory collapse depression of renal activity retention of nonprotein nitrogen in the blood subnormal temperature and finally death

INCIDENCE OF DIABETES

It seems probable from recent data that there are more than 2 000 000 cases of diabetes in the United States today Statistical reports have pointed out the in creasing frequency of the disease Joslin has estimated that there are 2 500 000 persons living in the United States today who either have or will develop diabetes Reports and surveys concerning the incidence of diabetes mellitus in other coun tries are not as yet available

An analysis of the incidence of diabetes in over 45 000 Army selectees shows that the disease is three to four times as prevalent among young adults as has hitherto been assumed on the basis of earlier studies It has been pred cted that if mortality rates continue to follow the same trend as at present in the United States by 1980 deaths from diabetes will be exceeded only by those from heart disease

Part of the increasing incidence of diabetes is merely apparent and is due to the general application of improved methods of case finding and treatment There actually are more cases however a fact which is partially explained by increased longevity of the population as a whole Diabetes is most frequently found in women *past middle life although no age is exempt*

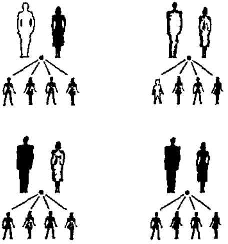
THE ULTIMATE CAUSE OF DIABETES IS UNKNOWN

HEREDITY AND OBESITY CONTRIBUTE TO ITS ONSET

Figure 2A

Heredity

The Mendelian type of heredity is a background for diabetes. Diabetes depends upon inheritance of a diabetic trait plus the effect of one or more secondary factors.



☐ Nondiabetic

☐ Diabetic Carrier

■ Diabetic

Figure 2B

Obesity

Diabetes is a penalty of obesity. Of 1,000 diabetics examined 770 were overweight.

The mortality rate from diabetes in men past age 45 increases with the degree of obesity.

Normal weight. Low diabetic *mortality*.

5 to 14 percent overweight. Mortality from diabetes doubles.

15 to 24 percent overweight. Mortality from diabetes is four times that of men with normal weight.

26 percent overweight. Mortality from diabetes is ten times that of men with normal weight.

FACTORS CONCERNED IN THE CAUSATION OF DIABETES

The immediate cause of diabetes mellitus is a deficiency of endogenous insulin Whether the blood-sugar-reducing principle elaborated by the pancreas of the diabetic is quantitatively or qualitatively deficient, or whether it is normal as originally produced but subsequently neutralized by other agents, the end result is insulin deficiency and diabetes Besides this immediate cause, however, there are certain predisposing factors

HEREDITY

A predisposition to diabetes seems to be inherited as a Mendelian recessive characteristic, this influence is now considered to be of primary importance, although such predisposition may not be revealed until late in life or even until long after the development of the disease It has been estimated that approximately one out of every four persons is a "diabetes carrier" (Figure 2A) In view of these facts, it is inadvisable for members of diabetic families to intermarry, because of the greatly increased probability that such intermarriages may produce diabetic offspring

OBESITY

How obesity predisposes to diabetes has not been explained, but the fact remains (Figure 2B) It has been stated that diabetes is the penalty of obesity and that the greater the obesity, the more likely is nature to enforce the penalty Obesity and overeating are usually associated, but overeating alone probably does not lead to diabetes It is well known that insulin, whether endogenous or exogenous, increases the appetite Possibly people overeat because their islands of Langerhans are initially overactive, eventually this overaction gives rise to exhaustion, and then too little, rather than too much, insulin is produced An increased incidence of diabetes parallels somewhat an improvement in the economic status of individuals or nations Apparently two causative forces operate to disturb the metabolic equilibrium of large masses of people under such circumstances More food material is taken in, and less muscular energy is expended to burn it up

Newburgh has shown that glucose tolerance tests may be returned to normal in more than three-fourths of those adult obese hyperglycemic patients who undergo adequate reduction of weight

ENDOCRINE FACTORS

It has long been observed that overweight predisposes to diabetes in the adult, although overheight is a frequent forerunner of diabetes in the child Such observations point to an endocrine factor, probably the pituitary gland The epochal work

of Houssay and others has finally proved a close interrelationship between this gland and carbohydrate metabolism More recently, the influence of the pituitary has been emphasized by the work of Young, who produced permanent diabetes in dogs by injecting anterior pituitary extracts Further investigations, confirmed by Best, revealed that the islet cells of the pancreas in these animals had been severely damaged and the actual insulin content of the islet tissue was extremely low The Toronto school and Lukens and Dohan and others have now demonstrated that islet-cell damage may be prevented or reversed by starvation or fat feeding and by controlling *active* diabetes by means of proper dietary measures in conjunction with exogenous Insulin More recent observations prove that hyperglycemia per se is the factor responsible for progressive islet damage The implications of this dis covery are far-reaching, especially since the experimental pituitary diabetes of animals has actually been cured by controlling the blood sugar level

The recent demonstration by Conn that the diabetic syndrome could be induced in normal men by administration of adrenocorticotropic hormone emphasizes still further the importance of the pituitary adrenal relationship

The adrenals—and thyroid—are in close relationship with the pancreas *Efforts have been made to treat diabetes from the endocrine standpoint*, with results which are inconclusive except in those cases resulting from surgically accessible adrenal tumors The adverse influence of hyperthyroidism upon diabetes is undoubted, and complicating factors of this type must be carefully considered when therapy is instituted

MISCELLANEOUS FACTORS

Other factors which sometimes seem to be responsible for the development of diabetes, but probably are rarely if ever causative, are infection, particularly of the gall bladder region, disease resulting in injury to certain areas of the midbrain, and *occasionally arteriosclerosis Traumatic diabetes is probably nonexistent* unless there is avulsion or destruction of the major portion of the pancreas

Although diabetes is seen most frequently in patients past middle life, no age is exempt and females are more commonly affected than males The incidence of the disease is greater among Hebrews than among Gentiles It is also greater among *Negroes than was formerly suspected Studies of the Indians of Arizona*, U S A, and inmates of institutions by Joslin emphasize the universality of diabetes The number of cases in any population is almost directly proportional to the search made for them It is said that diabetes among the Chinese and Japanese is not only infrequent but relatively mild The food of these peoples is largely carbohydrate, and their apparent relative *freedom from diabetes suggests* the possibility that a large proportion of carbohydrate in the diet is not the cause of the disease and per-

haps may even indicate the type of diet which is most suitable in its management Himsworth observed that the diets of persons who developed diabetes were higher in fat and lower in carbohydrate than those of normal people

PREVENTION OF DIABETES

Because of the etiological significance of obesity, the prophylactic value of avoiding overnutrition must be emphasized By urging the relatives of the diabetic to keep their weight within normal limits, the development of diabetes in those most susceptible to it might be prevented When diabetes or diabetic heredity exists, further transmission of the disease may be completely blocked only if the chosen partner in marriage is a nondiabetic member of a nondiabetic family (see Figure 2A)

If the conclusions drawn from experiments on animals may be applied to human diabetes, early diagnosis and efficient control of the active symptoms (hyperglycemia) may be expected to prevent further development of the defect

SYMPTOMS AND SIGNS OF DIABETES

The date of onset of diabetes is usually indefinite and its approach insidious The most characteristic symptoms of the disease are the passage of large amounts of urine, increased thirst, and excessive appetite, accompanied by loss of weight and strength The first symptom noticed by the patient is usually polyuria, since, in order for the kidney to dilute and eliminate the excess amount of sugar brought to it through the blood stream, large amounts of water must be abstracted from the tissues and passed as urine This same mechanism explains the next commonly encountered symptom, namely, polydipsia (excessive thirst) Loss of strength develops because the patient is deprived of the food value of the sugar lost in the urine and because the utilization of fat is imperfect as well Although the blood of the untreated diabetic may contain abnormally large quantities of sugar and fat, these substances cannot be properly utilized, so the patient literally starves amidst an abundance of food Thus polyphagia (excessive hunger) appears Other commonly encountered complaints are skin disturbances, such as localized or generalized pruritus, furuncles, carbuncles, and slowly healing ulcers disturbances of vision, numbness and tingling and pain (neuritis), especially in the lower limbs

The patient's urine contains sugar and usually has a high specific gravity Diacetic acid may also be present, indicating that acidosis exists Examination of the blood discloses a sugar content above normal, especially after meals

In mild cases, or soon after the actual onset of the diabetic state, glycosuria may exist without subjective symptoms and not infrequently it is the only early sign Such instances represent a diagnostic problem which demands sufficient study

to make possible a definite diagnosis Often diabetes will not be found without active search

DIAGNOSIS

The diagnosis of diabetes is a simple matter in most cases but may be difficult in instances in which glycosuria without symptoms is present Routine urine examinations will prevent mistakes

URINE EXAMINATION

The diagnosis of suspected diabetes in most cases may be easily made from the symptoms of the patient, associated with the discovery of sugar in the urine and hyperglycemia *It is the mild or unusual case that causes difficulty, and in some* instances repeated observations over a prolonged period of time may be required before certainty of the presence or absence of diabetes can be established Diabetes means lifelong treatment for the patient, a serious matter which demands that the diagnosis be based upon evaluation of complete evidence in each individual case

Joslin has emphasized the importance of making routine examinations of the urine for sugar, even in the absence of suspicious symptoms or a high urinary specific gravity "Practitioners in all branches of medicine should examine the urines of their patients or demand a recent urinary report I except no specialist, whether he be surgeon, ophthalmologist, otologist, laryngologist, gynecologist, neurologist, orthopedist, or dentist All would be incomparably rewarded if they made gratuitous examination of the urine for albumin and sugar for all patients coming to them The expense would be trifling, the good done would be enormous"

Sugar in the urine is presumptive evidence of diabetes until proved otherwise, but additional evidence should be actively sought if other symptoms are absent *Temporary glycosuria may occur for a few hours during* or following anesthesia, after shock, accidents, and injuries involving especially the head, or following severe fractures

For diagnostic purposes, specimens of urine passed within two hours after a hearty meal are particularly valuable *In a way, each meal constitutes a dextrose* tolerance test, and specimens passed two hours later may contain sugar when those obtained during the fasting state may be sugar-free Since glycosuria may be intermittent and not always continuous throughout the twenty four-hour period, it may be desirable in case of doubt to examine every urine specimen passed by the patient

A simple way in which to establish a diagnosis of diabetes is to make the examination of the urine after a meal of meat, potato, three slices of bread, a dessert rich in sugar, with coffee and sugar If normal, the urine should be sugar-

free before the meal and at one hour and two hours afterward This procedure will rule out or establish a diagnosis of diabetes in approximately 95 percent of cases, but to be entirely certain, simultaneous tests for sugar in both blood and urine are essential A dextrose tolerance test may be desirable in cases that still appear doubtful

Urinary examination, especially when each specimen of the twenty-four-hour urine is tested, will ordinarily detect practically all cases of diabetes except those associated with an *elevation* of the renal threshold for sugar Under such circumstances, true, uncontrolled diabetes mellitus may exist without glycosuria and the diagnosis can be established only by blood-sugar determinations

On the other hand, the renal threshold for sugar may occasionally be *reduced*, so that glycosuria may occur even though the blood sugar remains within normal limits (renal glycosuria) Blood-sugar determinations are essential in the diagnosis of such cases, and so long as hyperglycemia does not exist, antidiabetic treatment is not indicated

The finding of glycosuria immediately demands that an examination of the urine be made for diacetic acid, because in a diabetic the presence or absence of acidosis is a matter of greatest therapeutic importance (See pages 151 152 for methods of testing urine for sugar and for diacetic acid)

To avoid confusion in diagnosis, Joslin s standard may well be adopted With venous blood, blood sugar values of 170 or over obtained following meals are indicative of diabetes If hyperthyroidism coexists the postprandial level for diagnosis is raised from 170 to 200 Levels of 140 or above in persons who are in a fasting condition without other evidence arouse suspicion of diabetes and may call for a dextrose tolerance test

The level of blood sugar at which dextrose "leaks" through the kidneys and appears in pathologic amounts in the urine is known as the dextrose threshold The dextrose threshold in health is approximately 0 17 to 0 18 percent In other words, before glycosuria can occur in a normal person, about 180 mg of sugar per 100 cc of blood must be present

DEXTROSE TOLERANCE TESTS

In doubtful cases tolerance tests are widely used, but interpretation and technic vary greatly

Oral Method—Generally the height and length of the curve following oral administration of 100 Gm of dextrose solution in water have been the basis for interpretation Blood-sugar samples and urine specimens are collected prior to the test and at intervals of one-half hour, one hour, two hours, and three hours or longer

after administration of the sugar To individuals weighing under one hundred pounds, the dose may be 50 Gm , and to children under five years, 25 Gm Some observers prefer to give 1 5 Gm of dextrose per kilogram of body weight, others give the dose intravenously or administer the dextrose in multiple doses (Exton-Rose)

Most authorities classify a curve as normal if the blood sugar returns to its initial normal level within two hours The influence of previous diet is important, for normal individuals who are starved or fed diets high in fat will display a diabetic type of curve This factor can be eliminated by always insisting that the test be made under standard conditions of diet, including the ingestion of at least 250 Gm of carbohydrate daily for several days previously Infections, toxemia, age, and previous administration of Insulin are other factors capable of altering the response of the individual to carbohydrate Hypertension, nephritis, pregnancy, hyperthyroidism or hypothyroidism, and diseases of the liver, pituitary, or adrenals frequently result in abnormal findings

Diseases of the liver may result in curves of varying types, depending upon interference with the glycogenic function of the organ

A bizarre curve is occasionally encountered, the "lag storage curve," which displays a steep rise from the normal fasting level to 200 or even 300 after administration of dextrose but returns equally rapidly to the fasting level, although sugar may appear in the urine for two or three hours Such curves are probably produced by unusually rapid absorption of sugar from the intestine, since they occur not infrequently after gastroenterostomy

Intravenous Method—On account of their variability, due among other things to vagaries of absorption, the use of oral glucose curves for diagnostic purposes has been subjected to wide criticism and certain authorities believe they should be abandoned entirely Soskin suggests a more precise method and has published data useful as criteria for diagnosis It is especially helpful in cases of liver dysfunction If his criteria are adopted, it is essential that the method be followed *exactly* and that the blood-sugar determinations be made by one of the methods that measure only true blood sugar and not total reducing substances as in the case of the Folin-Wu procedure

The test is done in the morning before breakfast The dose of dextrose is ½ Gm per Kg of body weight, administered in 50 percent solution intravenously within a period of three to five minutes at the zero hour Blood samples are withdrawn before administration and at one-half, one, and two-hour intervals Arterial blood (finger puncture) is employed The normal curve returns to preinjection level within sixty minutes, the hepatic curve returns to normal after sixty minutes

and before 120 minutes, the diabetic curve returns to normal only after 120 minutes

Dextrose tolerance curves are of limited value in regulating treatment of diabetes Glycosuria represents the difference between glomerular filtration of sugar and its tubular resorption It is helpful to know the approximate level of the renal threshold, urine tests then give a fairly clear indication of the blood sugar level An elevation of the renal threshold for sugar is not infrequently found, especially in elderly diabetics, so that the true condition cannot be appreciated from urine tests alone Such cases suggest an impairment of renal function (diminished rate of glomerular filtration) In the latter months of pregnancy, the threshold is not uncommonly so lowered that dextrose appears in large amounts in the urine and leads to errors in treatment with Insulin unless the true condition is ascertained by blood-sugar estimations

SECTION 2

Dietary Treatment of Diabetes

FEW therapeutic procedures can be used with such assurance of benefit and with such precision as the modern treatment of diabetes mellitus The principles are diet, Insulin, and exercise, and with what is known today, deaths from diabetes indicate neglect

To the physician who interests himself in the treatment of the diabetic there comes an unusual amount of satisfaction, because his patient promptly becomes conscious of the favorable results The adequately treated diabetic can recognize tangible evidence of his improvement He need not depend upon a laboratory report showing that his condition has responded to treatment He is fully conscious of it If the diabetic patient is in coma, then proper treatment will save his life, if he is a chronic invalid because his diabetes has been neglected, then the correct management will not only prevent death from coma but may even afford the patient good health

Since the immediate cause of diabetes is insulin deficiency, treatment consists essentially in compensating for this deficiency Practically every diabetic manufactures some insulin of his own (endogenous insulin) Treatment, then, becomes a problem of adapting the patient's diet to his limited supply of endogenous insulin, and if his supply of endogenous insulin is so limited that he cannot metabolize an adequate diet, then Insulin (exogenous) should be administered

No uncertainty exists in the treatment of diabetes Not only can the degree of the defect in metabolic capacity of the diabetic be readily determined, but it is [illegible]

made adequate by supplementing with Insulin administered hypodermically

The metabolic load, of course, is the diet It not only should be qualitatively and quantitatively sufficient to restore and preserve health, but it should be ad-

justed to tax metabolic capacity as little as possible If the disease is mild, diet and exercise suffice, if severe, Insulin is required in amounts sufficient to supplement properly the insulin the diabetic makes for himself Thus, diet becomes the keystone of treatment, and it is the diet problem that generally constitutes the most troublesome phase of practical management

Hospital treatment of the diabetic, although often desirable, is by no means always essential It is, for many reasons, beyond the reach of a large number of patients The diabetic patient who cannot go to the hospital need not be denied the benefits of modern treatment, for the fundamentals may be easily mastered with a little assistance from the physician The education of a diabetic and his family is always essential to success in treatment Unless the patient and his family are taught how to harmonize diet, the dose of Insulin, and exercise under various conditions of life, the whole structure of treatment is liable to collapse during even a minor emergency

DIET

New discoveries and changing viewpoints have profoundly influenced the type of diet advocated for the diabetic The selection of the diet best suited for the individual patient is a problem which must be settled by the physician Divergence of opinion makes it improbable that any single type of diet will meet with universal approval The fundamental principle, so thoroughly established by Allen, is to avoid overfeeding Upon moderate undernutrition depends the success of any diet which has been successfully employed, but since the discovery of Insulin by Banting and Best, undernutrition no longer requires starvation Nevertheless, the diabetic diet is emphatically a quantitative diet, and this principle implies accurate control of the intake of food It matters little what means of measurement of food is adopted, scales are best in the end, but household measures in cups and spoons will serve if scales are not available Actually weighing food for a few months will well repay the patient by enabling him to estimate more accurately the quantities of food to be taken whenever he is without means for measuring the diet

The optimum diet for a diabetic patient is the diet that will keep him well and strong and at the same time not permit his weight to rise above the ideal Several requirements must be satisfactorily met The diet should be palatable and satisfying both in quality and in quantity, it must supply correct caloric requirements of the individual, it must contain proper proportions of carbohydrate, protein, and fat, and it must satisfy long-time nutritional requirements for vitamins and mineral salts in order to prevent the ultimate development of deficiency disease Therefore, the diabetic diet must be planned to supply requirements for a lifetime Gain or loss of weight will determine whether correct caloric requirements are being satisfied

CALORIC REQUIREMENT

The caloric intake represents the fuel for the body The body s needs for fuel are variable depending upon age weight height sex exercise and metabolic peculiarities The average person weighing 70 Kg (154 lb) and doing moderate work ordinarily chooses a diet containing a daily total of approximately 400 Gm of carbohydrate 100 Gm of protein and 100 Gm of fat which provides 2 900 calories or approximately 40 calories per kilogram of body weight

Arbitrary rules are by no means infallible but for practical purposes the basal metabolism for twenty four hours may be estimated and a definite percentage increment allowed for occupation The general recommendation of allowing the adult diabetic 25 to 30 calories per kilogram of normal or ideal body weight is often made and it is especially helpful as a guide in treatment Obviously a latitude of a few hundred calories exists and *the best guide for determining the maintenance caloric requirement is the general condition of the patient especially as regards weight and strength and in children growth* Although an allowance of 25 to 30 calories per kilogram of body weight is useful as a guide this amount should be reduced in the elderly or obese or increased in children and malnourished patients to meet individual requirements An easy practical method of calculating the total calories is to multiply the ideal weight in kilograms by twenty five for basal conditions by thirty if the patient is moderately active or by thirty five or more if the occupation is strenuous Another procedure is to follow the simple directions which accompany the chart on page 155 of this book The figure for the *theoretical* caloric requirement thus obtained is especially useful as a tentative objective but subsequently *the best guide to the proper caloric requirement is the patient s weight and strength*

[illegible]

to be 10 percent less In this case the normal we ght may be regarded as deal but if we w sh to mainta n sl ght undernutr t on 5 pounds (plus 6 pounds for clothing) may be subtracted (152 − 11) leaving 141 pounds or approx mately 64 Kg (141 + 2 2) Locate the po nt represent ng 14 [illegible]

1 630 calor es)

To provide extra calories for activity the follow ng table may be used

For room rest	add 10 percent
For very light work	add 20 percent
For ord nary sedentary work	add 30 percent
For moderately heavy work	add 40 percent
For manual labor	add 50 percent
For growing ch ldren	add 50 to 70 percent

Having decided on the additional calories required in this instance 40 percent add this figure to the basal requirement to obtain the theoretical total daily maintenance requirement which is 2 282 calories (40 percent of 1 630 = 652 1 630 + 652 = 2 282) In this instance, however

In patients who are grossly overweight, loss of weight should be accelerated by prescribing 20 to 30 percent fewer calories than the basal requirement Vitamin and mineral deficiencies may be induced by such diets unless vitamin concentrates and calcium are prescribed *

Having thus determined the caloric requirement of the patient, the next step is the translation of this requirement into the proper proportions of carbohydrate, protein and fat, and finally the conversion of these figures into an actual *menu*

PROPORTION OF CARBOHYDRATE, PROTEIN, AND FAT

Economic factors have dictated the diets of large parts of the population, and the older surveys called for 60 to 70 percent of the calories in the form of carbohydrate Dubois and Chambers point out that recent emphasis on total nutrition and the biological value of proteins tends to increase the fat content and decrease the total of carbohydrates in the modern dietary in many countries It is recommended that the general diet consist of approximately 40 percent of its caloric value as carbohydrates, 15 percent as protein, and 45 percent as fat Such a diet will contain about twice as much carbohydrate as fat, and one gram of protein per kilogram of body weight

High fat, low carbohydrate diets have in the hands of some clinicians produced good results On the other hand, good results with high-carbohydrate, low-fat diets are reported by others Although undernutrition, long recognized as a valuable therapeutic principle in diabetes, may in part explain the success of radically different types of diet, these experiments constitute a significant contribution tending to indicate that a wide dietetic latitude exists, and it further suggests the importance of the time element in the final evaluation of a given type of diet

Protein—There is general agreement on the quantity of protein required by diabetic patients The requirement varies with age, weight, and activity, as well as the condition of the kidneys The ad diabetic is usually given about 1 to 1 5 Gm of

*A Lilly booklet entitled *Vitamin* ... upon request.

protein per kilogram of body weight, 1 Gm is a safe average In patients having proteinuria, it is sometimes desirable to increase this amount in order to compensate for low serum-protein values and to prevent edema In the acute stage of glomerulonephritis, it may be desirable to allow only 0 6 Gm of protein per kilogram of body weight In diabetic children, it is especially important to supply enough protein to provide for growth, an average allowance for children is approximately 3 Gm per kilogram of body weight Each gram of protein furnishes 4 calories of heat

Carbohydrate—There has been a wide latitude in the amounts of carbohydrate prescribed by various authorities and in recent years a decided trend toward the adoption of diets more nearly approaching those of normal individuals For the total daily allowance of carbohydrate Joslin has suggested 100 Gm as the lower limit and 200 Gm as the upper limit, although the latter is sometimes exceeded with children Such a range avoids extremes and tends automatically to adjust the fat allowance at a moderate figure Each gram of carbohydrate yields 4 calories

Good results have been obtained with diets containing widely varying amounts of carbohydrate, especially when slight undernutrition is imposed There is little or no advantage in too rigorously restricting carbohydrate, nor does it appear desirable to go to the other extreme in a disease characterized by a defect in carbohydrate metabolism

Diets containing as many as 3 or 4 Gm of carbohydrate to 1 Gm of fat have been frequently used, but since the introduction of long-acting Insulins there has been a tendency to recede from such high ratios Fortunately, restriction of fat in the diabetic's diet often brings about improvement in the patient's tolerance for carbohydrate, so that *moderate* increases may be made in carbohydrate at the expense of fat without necessitating an increase in Insulin dosage Usually, a ratio of 1 5 to 2 Gm carbohydrate to 1 Gm fat will adequately satisfy most requirements

Fat—Prior to the use of Insulin, Shaffer, Woodyatt, and others pointed out that the amount of fat the diet might safely contain without predisposing to ketosis was limited by the amount of available dextrose in that diet (ketogenic-antiketogenic ratio) In order to make up for the deficit in caloric value occasioned by carbohydrate restriction, fat, which yields per gram more than twice as many calories (9 calories per gram) as other foodstuffs, was then allowed in very liberal quantities The ratio of carbohydrate to fat in such diets was the reverse of that present in the diets of healthy people

The discovery of Insulin by Banting and Best at the University of Toronto

made possible a beneficial change in the diabetic's diet, so that an increased allowance of carbohydrate could be supplied, which in turn permitted an adequate total caloric intake with less fat and without danger of acidosis In recent years, as more of the fat in the diabetic's diet has been replaced by carbohydrate, with the utilization of adequate amounts of carbohydrate assured when necessary with Insulin mathematical calculation of the ratio (Glucose/Fatty Acid) has become unnecessary, and it is now a matter of only historical interest Furthermore, Mirsky, Stadie, and others have pointed out the independence of the carbohydrate and the fat oxidizing systems and there is no longer any question that ketosis is due to lack of carbohydrate Any phenomenon that will accelerate glycogen depletion in the liver—e g Insulin deprivation hyperthyroidism, hepatitis, infection, surgical procedures, gastro-intestinal disturbances vomiting—will result in a secondary acceleration of fat oxidation with consequent production of excessive amounts of ketone bodies

Since fat is potentially ketogenic, since the possibility exists that in excess amounts it may also be a factor in predisposing to arteriosclerosis, and since its minimal physiological requirement is not precisely known, it seems desirable that the amount of fat supplied in the diabetic s diet should not differ radically from the quantity ordinarily taken in health namely, about 50 and 100 Gm daily for young children and adults, respectively It is rarely necessary to give more than 150 Gm. per day an allowance less than this is usually possible and may be preferable

CALCULATION OF THE DIET PRESCRIPTION

To conform with the requirements discussed above, a diet formula can be constructed which will be applicable to the ordinary case of diabetes Such a diet prescription should

1 Prevent overnutrition by restricting total caloric intake

2 Provide a protein allowance ranging between 0 6 and 1 5 Gm per kilogram of body weight for adults (usually 1 Gm) and up to 3 Gm per kilogram of body weight for children

3 Distribute the remaining calories on such a basis that the carbohydrate allowance is between 100 and 200 Gm daily and the fat allowance not greatly different from normal (50 to 100 Gm) A carbohydrate to-fat ratio of approximately 1½ or 2 Gm carbohydrate to 1 Gm fat will in general accomplish this result and has in addition the virtue of avoiding undesirable extremes

To calculate the diet prescription (see also Short Method, page 36), first make the protein allotment, for instance 1 Gm per kilogram (2 2 lb) of body weight and calculate its caloric equivalent Subtract this figure from the total calories that have already been computed The remainder represents the number of

calories to be supplied by carbohydrate and fat. When divided by the sum of the calories supplied by carbohydrate and fat in the ratio chosen (e.g., 2 Gm. carbohydrate to 1 Gm. fat $= 2\times4+1\times9=17$ calories), the result is the number of times this combination must be taken in the prescription. Multiply by the number of grams of carbohydrate and fat in the ratio to complete the dietary prescription.

EXAMPLE OF BASAL METHOD

It was previously suggested that the patient whose maintenance caloric intake was calculated on page 31 should receive only a basal diet at the institution of treatment since he is already overweight. His total requirement was calculated on the basis of a weight of 141 pounds (64 Kg.).

Normal weight 152 lb. − 6 lb. clothing − 5 lb. for slight undernutrition 141 lb. (141 ÷ 2.2 = 64 Kg.)
Basal caloric requirement (using chart on page 155) 1 630 calories

Protein 1 Gm. per kilogram body weight = 64 Gm. protein. Calories supplied (64×4) 256 calories

Remaining calories to be apportioned between carbohydrate and fat (1 630 − 256) = 1 374 calories

Calculation of number of grams fat and carbohydrate

A. If apportioned in a ratio of 2 carbohydrate to 1 fat

(a) Sum of calories supplied by 2 C + 1 F $(2\times4+1\times9)=17$ calories
1 374 ÷ 17 = 80, which is number of times 2 Gm. C and 1 Gm. F will be required to supply 1 374 calories
The fat allotment then is 80 Gm.

(b) Calculation of number of grams carbohydrate
Number of times 2 Gm. C + 1 Gm. F are required $(80)\times2=160$ Gm. C

The diet prescription in round numbers is then

C	P	F
160	64	80
×4	×4	×9
640	256	720
		256
		640
		1 616 calories

which is sufficiently accurate for practical purposes. Such a diet may be chosen by the physician as his basic diet from which individual simple adjustments upward or downward may easily be made by adding slices of bread to increase carbohydrate content or butter to increase the amount of fat supplied. This diet is also close to the approximate theoretical requirement if calculated on the basis of 25 calories per kilogram (25×64 = 1 600 calories).

B If apportioned in a ratio of 1 5 carbohydrate to 1 fat

(a) Calculation of number of grams of fat
Sum of calories supplied by 1 5 C + 1 F $(1\ 5\times4+1\times9)=15$ calories
$1{,}374-15=91$, which is number of times 1 5 Gm C and 1 Gm F will be required to supply 1,374 calories and represents the number of grams of the fat allowance

(b) Calculation of number of grams carbohydrate
Number of times 1 5 C and 1 F are required $(91)\times1\ 5=136\ 5$ Gm C

The diet prescription, in round numbers, is then

$$\begin{array}{ccc} \text{C } 135 & \text{P } 64 & \text{F } 91 \\ \times4 & \times4 & \times9 \\ \hline 540 & 256 & 819 \\ & & 256 \\ & & 540 \\ \cline{3-3} & & 1{,}615 \text{ calories} \end{array}$$

SHORT METHOD

To determine basal caloric requirement, multiply kilograms of ideal body weight by twenty-five The diet prescription is to provide 40 percent of the total calories in carbohydrate, 15 percent in protein, and 45 percent in fat

For example The patient's ideal weight is 141 lb (64 Kg)

$$64\times25=1{,}600 \text{ calories}$$

Point off one decimal for total grams carbohydrate One-half this amount is the fat Give one gram of protein for each Kg body weight

(The figures may be proved as follows

$$\text{Carbohydrate—}40\%\times1{,}600=\frac{640}{4}\text{ Cal }=160\text{ Gm}$$

$$\text{Protein—}15\%\times1{,}600=\frac{240}{4}\text{ Cal }=60\text{ Gm}$$

$$\text{Fat—}45\%\times1{,}600=\frac{720}{9}\text{ Cal }=80\text{ Gm})$$

In prescribing a diet, it is well to bear in mind that normally all foods vary considerably in their values of carbohydrate, protein, and fat Consequently, one need not add to the complexities of calculation by carrying through fractions of a gram In fact, variability of even accurately weighed diets is such that one can with perfect safety prescribe a diet number within a few grams of that estimated Thus, one may use round numbers

Ratios of three to one or four to one carbohydrate to fat are sometimes employed Rabinowitch emphasized that when this higher-carbohydrate, low-fat, low-calorie type of diet is followed, the fat content of the diet should be kept extremely low, not exceeding between 50 and 60 Gm Such diets are effective for pur-

poses of weight reduction, but a diet having an abnormally low fat content is about as disagreeable to many patients as the older low-carbohydrate high fat diets in vogue fifteen to twenty years ago

LADDER METHOD

The well known variability of foods and the fact that the individual patient s requirements are so inconstant have led some clinicians to adopt a series of progressively larger diets based on a single standard diet which is suitable for instituting treatment in the average uncomplicated case This is a simple procedure since the series of diets need not be very large It likewise permits the application of the ladder method of treatment The patient begins with a small diet which is increased by successive stages as improvement occurs or as is shown necessary by weighing the patient once or twice weekly and ol serving his general condition

The ladder method has several advantages The total amounts of food given during the early period of treatment are well below actual requirements the patient becomes sugar free more quickly undernutrit on tends to increase carbohydrate tolerance and a smaller primary dose of Insulin is required There is less danger of precipitating hypoglycemia than is the case when one prescribes a basal or maintenance d et and then tries to adjust the Insulin dosage to the metabolic load

CONVERSION OF DIET PRESCRIPTION INTO MENU

If the physician can have the services of a dietitian he need not concern himself very much with the details of a menu but dietitians are not always available and to most patients beginning treatment a diet prescription calling for carbohydrate protein and fat in terms of grams and calories is a mysterious thing Probably no single factor is more effective in dispelling this mystery than food scales When the diabetic is at home his food scales may often be conveniently placed upon the family table and the appropriate kinds and amounts of foods selected from those available When away from home his previous experience with the scales will tend to make his estimates of food more accurate

TESTS FOR EVALUATING CONTROL OF DIABETES

When a diabetic first presents himself for treatment a fixed value cannot at once be placed upon his carbohydrate tolerance but it is nevertheless possible to prescribe *a diet having a fixed and known value* Whether one chooses to begin with a maintenance diet, a basal diet or one even lower in value the principle remains the same to effect eventually a balance between metabolic capacity and metabolic

load The difference between these will be expressed by the blood-sugar level and the excretion of sugar into the urine, and observation of these indexes and the weight and general condition of the patient indicates the necessity for alterations in the diet or the administration of Insulin

Most diabetics have normal renal thresholds and will excrete sugar in the urine whenever the level of sugar in the venous blood rises much above 170 or 180 mg per 100 cc If the kidneys are normal, urinalysis alone may be a satisfactory guide for routine diabetic control In any event, the patient should be taught to use the Benedict test (page 151) or the Urine Sugar Test Case, Sheftel The latter is a simple method of quantitative analysis, but if it is not available, a rough estimate can be made by recording the color changes of the Benedict test as red (4+), orange (3+), yellow (2+), or green (1+)

Urine specimens should be collected in four fractions daily the urine voided (a) between breakfast and lunch, (b) between lunch and dinner, (c) between dinner and bedtime, and (d) between bedtime and breakfast Each specimen should be examined separately and the results recorded on a chart, which will provide a basis for adjustment of the dose of Insulin Thus, the presence of sugar in the night specimen and its absence from other specimens would indicate that the evening dose of Insulin should be increased or the evening meal reduced in amount

The dose of NPH Insulin may be regulated by observations of the amount of sugar in the urine specimen passed on arising in the morning or the one a half hour later When this specimen becomes sugar free, the dose can usually be considered adequate Should sugar still appear in the specimens taken during the late morning or early afternoon, readjustment of the diet or the provision of a supplementary dose of unmodified Insulin is indicated

The ferric chloride test for acetoacetic acid is a simple means for determining the presence of acidosis (page 152) It should be made routinely in all cases in which large amounts of sugar are present in the urine, and a positive test is a danger signal which indicates an imperative need for more active control of the diabetes with Insulin, fluids, and possibly intravenous infusion of dextrose and salt solution

Ordinarily, in severe cases requiring Insulin, the quantity of sugar in the blood is highest just before breakfast and lowest just before lunch Therefore, before the patient is released from the frequent observations which characterize the early days of treatment, the blood sugar, especially at the hours mentioned, should be estimated Blood-sugar estimations always make treatment easier, safer, and quicker If glycosuria and hyperglycemia are not controlled by diet alone, exogenous Insulin should be administered

SECTION 3

Treatment with Insulin Preparations

An important problem concerns criteria for the control of diabetes Is it necessary, or even desirable, to avoid hyperglycemia and glycosuria? Arguments have been advanced pro and con for several years Some investigators have reported observations on patients who have been allowed to spill large quantities of sugar without obvious damage Others, Joslin for example, cite the evidence accumulated over many years that laxity in diabetic therapy exposes the patient to the danger of complications The evidence now available seems to favor preponderantly the maintenance of the diabetic's body chemistry within normal (or natural) limits

Recent experiments place the treatment of diabetes on a much firmer foundation than ever before Mirsky, Stadie, and others have elucidated the independence of the carbohydrate and the fat-oxidizing systems, and have shown that any phenomenon that will accelerate glycogen depletion in the liver—such as Insulin deprivation, hyperthyroidism, infection, hepatitis, gastro-intestinal disturbances, surgical procedures, anesthesia, vomiting—results in secondary acceleration of fat oxidation with consequent production of excessive amounts of acetone bodies Soskin believes that it has been an all too-common fallacy to assume that the diabetic has been restored to a normal state because hyperglycemia and glycosuria have been controlled However, this is not necessarily so unless the means by which control was accomplished has also led to replenished glycogen stores in the body It is evident from his experiments that 300 to 500 Gm of carbohydrate are needed to restore a comatose diabetic to normal by the end of the first twenty-four hours About one-half of that amount will be required during subsequent days in order to maintain normal glycogen stores and carbohydrate metabolism Anything which depresses normal glycogen storage is obviously wrong and consequently dangerous, regardless of how well it may control the blood-sugar level and the wastage of sugar in the urine For example, the high-fat diet might be considered in the same category as synthaline, a toxic drug, which lowers the blood sugar level

by damaging the liver With these considerations in mind, it is possible to formulate a fundamental principle in diabetic therapy, namely *Give enough carbohydrate (and protein) to protect the liver*

Another series of investigations has revealed that the production of permanent diabetes in animals following administration of pituitary diabetogenic substances may be prevented or cured by dietary means or by the administration of Insulin Hydropic degeneration of the beta cells of the islands of Langerhans was characterized many years ago by Allen as the typical lesion of *active* diabetes, and he demonstrated that this lesion could be prevented by control of the disease At this time the only means of control was starvation More recently, by a carefully devised set of experiments, Lukens and Dohan have shown that hyperglycemia per se is the factor underlying the development of these pathological changes in the islet tissue Hence, another great principle of treatment may be added to the former *Give enough Insulin to protect the islet cells of the pancreas from further injury* Both these objectives are obtainable by quantitative dietary management and the administration of Insulin

INSULIN

Insulin is an aqueous solution of the active antidiabetic principle derived from the islands of Langerhans of the pancreas When a diabetic is given Insulin in appropriate doses and under suitable conditions, he is enabled to utilize carbohydrates and fats in a comparatively normal manner, the concentration of sugar in the blood is confined within normal limits the urine remains free of sugar and ketone bodies, and diabetic acidosis and coma are prevented The effect of a dose of this unmodified Insulin ordinarily lasts for five or six hours or more

INSULIN MADE FROM ZINC-INSULIN CRYSTALS

Insulin made from zinc-Insulin crystals is a solution of a crystalline preparation containing the active antidiabetic principle of the pancreas together with a small amount of zinc, this element having been combined with the active principle in the formation of zinc-Insulin crystals Such crystals are typical of the only forms in which the active antidiabetic principle has been prepared in a chemically pure, crystalline state Because of its purity, use of Insulin made from zinc-Insulin crystals is particularly indicated in those patients who show or are expected to show an allergic reaction to Insulin (see page 62)

The antidiabetic effect of Insulin is essentially the same whether the solution is made from crystalline or noncrystalline preparations of the active antidiabetic principle, and either preparation may be employed routinely in nonallergic cases

in which a rapidly acting Insulin is indicated The rapidity of onset of hypoglycemic effect as well as the duration of action of Insulin made from zinc-Insulin crystals is identical with that of Insulin of amorphous origin

Insulin made from either crystalline or noncrystalline sources is rapidly absorbed and is usually best administered subcutaneously fifteen to thirty minutes before a meal, so that its physiological effects will parallel the absorption of dextrose It should not be injected into the same area of the body oftener than once a month The thighs and arms are the sites usually selected for injection Insulin is measured in units and can be obtained in concentrations containing respectively 40 and 80 units per cc Because of economy and the advantage of reducing the bulk of each injection to prevent discomfort these concentrations have usually been employed One unit, on the average will metabolize one to four grams of sugar but considerable variation occurs, depending upon individual circumstances a contingency that obviously necessitates individual study of each case

THE LONG-ACTING INSULINS

In spite of the excellent results obtained in the majority of cases, there has remained a severe type of diabetes in which even multiple daily injections of Insulin have failed to prevent hyperglycemia and hypoglycemia, attended by the disadvantages and undesirable effects of these conditions Such difficulties have been ascribed largely to the fact that Insulin is freely soluble in the body fluids and is presumed to be absorbed rapidly, with the result that it exerts its maximum effect within three to four hours after being injected

It was long recognized that a preparation of Insulin effective over a greater period of time might obviate such poor results since its effects might more nearly simulate those of the internal secretion of the pancreas in the nondiabetic individual and might be particularly useful in combating the hyperglycemia which occurs during the night in many cases of diabetes It was recognized also, that the comfort and well-being of many diabetic patients could be greatly increased by use of a preparation which would have a gradual blood sugar-lowering action and be capable of maintaining blood-sugar levels within normal limits thus eliminating the ill effects of periodically recurring hyperglycemia and causing unpleasant periods of hypoglycemia to be reduced in frequency or even avoided entirely

Cardonnet has summarized this point stating that "The greatest advantage of depot Insulins is not so much the fact that a smaller number of injections is required, but that with them it is easy to get a continuity of action that is very difficult to obtain with short-action Insulins *even when injections are repeated* A continued action is fundamental to avoid periods of protein destruction and ketosis"

PROTAMINE ZINC INSULIN

Protamine Zinc Insulin is prepared by mixing Insulin, protamine, and zinc with a buffered solution When this preparation is brought into uniform suspension, each cubic centimeter contains either 40 or 80 units of Insulin, together with approximately 1 25 mg of protamine and approximately 0 2 mg of zinc per 100 units of the Insulin The strength of the preparation is clearly stated on the label of each package and vial In Protamine Zinc Insulin the active material is present in the finely divided, insoluble, milky-white precipitate and not in the clear supernatant fluid It is of the utmost importance, therefore, that a constant proportion of this precipitate be present in each dose injected *To insure this result, the vial should be rotated and inverted from end to end several times immediately before the withdrawal of each dose for injection* Failure to observe this precaution can lead only to marked irregularity in the results obtained Vigorous shaking, with consequent frothing of the material, should be avoided as much as possible consistent with obtaining a *uniform* suspension

Beginning as early as 1923, attempts were made to prolong the blood-sugar-lowering effect of Insulin, but none of the methods employed was found to be of practical advantage in the treatment of diabetes Unmodified Insulin has its minimum solubility at approximately *p*H 5 and is completely soluble at the *p*H of the body fluids (approximately 7 4), with the result that following injection it is almost immediately taken up by these fluids Hagedorn and his co-workers, of Copenhagen, reasoned that an Insulin preparation having a very low solubility at the *p*H of the body fluids might be absorbed with much less rapidity With this in mind they developed a series of protamine-Insulin preparations, finding that when Insulin is mixed with a properly buffered solution containing protamine, a protamine-Insulin precipitate is formed The solubility of this precipitate and its absorbability in the body fluids are very low Consequently, upon subcutaneous injection of a suspension of the precipitate, there is made available a depot of supply from which Insulin is slowly dissolved by the body fluids The blood-sugar-lowering effect exerted by protamine-Insulin was found to persist from two to four times as long as that of unmodified Insulin Several hundred reports relating to these preparations and their use have been published There is no doubt that Protamine Zinc Insulin has added materially to the well-being and comfort of most of the diabetic patients in whom it has been employed

RELATIONSHIP OF ZINC AND INSULIN

Several other investigators, utilizing methods different from those of Hagedorn, also reported progress in prolonging the action of Insulin At the University of Toronto, following the discovery by Scott that crystallization of Insulin could be

accomplished only in the presence of zinc, nickel, cobalt, or cadmium, Scott and Fisher found that Insulin containing 0 01 percent of zinc showed only 40 percent of its activity when mice were used in assaying it, which in this case indicated a delayed action In rabbits, the action of Insulin containing 0 1 percent of zinc extended over a period of ten hours, while the amount of sugar metabolized was equivalent to or greater than that metabolized by a similar quantity of Insulin containing no zinc

These interesting relationships between zinc and Insulin led the Toronto observers to investigate the effect of adding small amounts of zinc to protamine-Insulin They found that in causing prolonged lowering of blood-sugar levels, protamine-Insulin preparations of low ash content were not as effective as corresponding preparations to which zinc had been added Consequently, it was shown that zinc plays a very important role in these preparations

POTENCY

The amount of dextrose that 1 unit of Insulin of amorphous or crystalline origin enables the body to utilize will vary in different individuals and under different circumstances, but it is usually from 1 to 4 Gm Early observers found that Protamine Zinc Insulin permitted the utilization of as much as 20 percent more dextrose per unit than does Insulin This is not a constant factor, however, and it is more than likely that the saving noted has been due to the fact that carbohydrate tolerance improved considerably in the groups of patients studied

DURATION OF ACTION

Estimates of the duration of action of protamine-Insulin preparations have naturally varied with methods employed for its measurement Wilder and others found in many clinical observations that the influence of individual large doses of these preparations extended into the third day It was demonstrated that in a patient receiving food at two-hour intervals, the greatest effect of a large dose of Protamine Zinc Insulin develops in from fourteen to twenty hours after its administration, with evidence of effect extending well beyond a twenty-four-hour period In fasting patients, a single injection of Protamine Zinc Insulin has maintained hypoglycemic levels for as long as forty-eight to seventy-two hours As in the case of unmodified Insulin, the larger the dose given, the more prolonged will be the effect

ADMINISTRATION

Protamine Zinc Insulin should be administered deep in the subcutaneous tissues, *never intravenously* It is not intended to replace rapidly acting Insulin in dealing with acidosis and emergencies

Generally speaking two alternative procedures for the administration of Protamine Zinc Insulin have been utilized the Danish method of substituting the dose of a protamine Insulin preparation for the evening injection of Insulin and the American technic of administering Protamine Zinc Insulin in the morning before breakfast Present usage of the product in the United States distinctly favors the latter method

NPH INSULIN

NPH Insulin has an improved time action which is intermediate between that of Insulin and that of Protamine Zinc Insulin In general its effects are manifested over a period of about twenty eight to thirty hours and are considerably more rapid in onset than those of Protamine Zinc Insulin but they have sufficient duration to maintain desirable levels of blood sugar during fasting Because of its more efficient timing characteristics its use obviates the necessity for supplementary daily injections in the majority of cases Furthermore should supplementary injections be required the addition of Insulin to NPH Insulin will be reflected more directly in its action than is the case when Insulin is mixed with Protamine Zinc Insulin Extensive clinical trials on a world wide basis have demonstrated the advantages of having a preparation such as NPH Insulin for routine use in the management of diabetes

Each cubic centimeter of NPH Insulin contains either 40 or 80 units of Insulin and an amount of protamine sulfate sufficient to combine chemically with the Insulin present to form crystals of Insulin protamine and zinc The strength of the preparation is clearly stated on the label of each package and vial Doses are prescribed in terms of *units* The volume of any prescribed dose will depend upon the strength of the preparation which is being used

NPH Insulin has been developed as a consequence of clinical investigation of a large series of intermediate acting Insulin modifications and of mixtures of Insulin and Protamine Zinc Insulin given as a single daily dose in the management of diabetes It was found that such mixtures (usually in the ratio of two parts of Insulin to one part of Protamine Zinc Insulin) when administered once in the morning would in the majority of cases have the pharmacologic effect of doses of Protamine Zinc Insulin supplemented by separate injections of Insulin even when the latter were required once or twice a day for over all control of glycosuria and hyperglycemia Because of possible sources of error in dosage and relative inconvenience of extemporaneous mixtures a preparation as stable as Protamine Zinc Insulin yet incorporating the desirable time activity of a mixture was sought From studies of a large series of possible modifications NPH Insulin has been chosen as most nearly duplicating the clinical effects and timing which seem most suitable for the greatest number of cases

Clinical studies indicate that NPH Insulin is intermediate in action between the rapid but short effect of Insulin and the very slow but prolonged action of Protamine Zinc Insulin However, the duration of activity of NPH Insulin is sufficient in most cases to assure an overlap of effect adequate to maintain satisfactory blood sugar levels in the fasting condition, and its depot effect is somewhat longer than that of Globin Zinc Insulin Furthermore, the onset of action of the preparation is usually prompt enough to provide for adequate control of the after-breakfast rise in blood sugar which formerly called for supplemental doses of unmodified Insulin

Unmodified Insulin is the preparation of choice in the treatment of diabetic emergencies in which immediate action is essential Protamine Zinc Insulin is frequently adequate in the routine treatment of mild diabetes in patients requiring 30 or less total units of Insulin daily However, the group of unstable patients with more severe diabetes cannot be controlled adequately on such a simplified dosage plan, when receiving Protamine Zinc Insulin, they also need supplemental doses of unmodified Insulin as well, or mixtures of Insulin and Protamine Zinc Insulin can be used NPH Insulin, because of its more rapid intensity of action after injection plus its moderate overlapping effect, is believed to accomplish the same purpose, thereby combining some of the advantages and eliminating some of the disadvantages of both the very short and the very long acting Insulin preparations The duration of effect of NPH Insulin, although not as great as that of Protamine Zinc Insulin, is still sufficiently long to protect the patient from one day to the next

INSULIN THERAPY

INDICATIONS FOR VARIOUS PREPARATIONS

Present indications for Insulin therapy are summarized in Table III (1) *always* in diabetic children (2) *always* during complications, such as infections, surgery, delivery, and diabetic coma and (3) in all other cases that demonstrate an inability to maintain normal weight and strength without hyperglycemia and glycosuria

Long acting Insulins, because of their slower and more prolonged effect, have been regarded as the foundation or basic Insulin in practically all cases unmodified Insulin, prepared from either amorphous or crystalline material, is employed as a supplement when a quick and short but powerful action is required Rapidly acting Insulin is especially indicated in emergencies and during complications, when the requirement for Insulin fluctuates rapidly, in very young children, who are incapable of intelligently interpreting symptoms of hypoglycemia, and as a supplement to the long acting types

TABLE III • *Insulin Therapy*

General Indications

1 All diabetic children
2 Complications—e g , infections, surgery, pregnancy, coma
3 Inability to maintain normal weight and strength without hyperglycemia and glycosuria

Indications for Various Preparations

A NPH INSULIN
 1 Basic, including cases with higher dosage requirements
 2 To supplant multiple-dose technic and mixtures

B PROTAMINE ZINC INSULIN
 1 May be used alone in milder cases

C INSULIN
 1 Emergencies and complications
  (a) Acidosis and coma
  (b) Acute infections
  (c) Chronic infections with fluctuating Insulin requirement
  (d) In surgery, operations, and delivery
 2 Very young children
 3 Supplementary to Protamine Zinc Insulin and NPH Insulin

D MIXTURES OF INSULIN AND PROTAMINE ZINC INSULIN
 1 Largely replaced by NPH Insulin

Insulin should be given *immediately* in the following circumstances

1 In the severe case, in which the patient is obviously ill and is suffering from severe thirst and dehydration and usually from malnutrition

2 If the patient has ketosis, as shown by a positive ferric chloride test Emergency treatment (see page 82) may be necessary

3 If complications exist, such as intercurrent disease, acute or chronic infection, sepsis, gangrene, or hyperthyroidism

4 In the young diabetic, who may more readily recover some of his lost carbohydrate tolerance the sooner the disease is controlled

In uncomplicated cases, a trial period of three or four days on a maintenance, basal, or low ladder diet without the administration of Insulin may first be instituted in order to determine the patient's own metabolic capacity

Should the urine not become sugar-free soon after institution of the diet, the physician may, even on the second day of treatment, either decrease the caloric intake, if time is not a factor, or begin the use of Insulin in 3 to 5-unit doses before meals In severe cases in which immediate treatment with Insulin may have been

begun the day before, the dose can be increased to 7 to 10 units before breakfast and 7 to 10 units before the evening meal and the noon dose maintained at 5 units The presence of infection, hyperthyroidism, or some other complication is to be suspected, sought for, and appropriately treated if glycosuria is persistent Treatment during the next few days becomes a problem of watching the sugar content of the urine, gradually building up the diet by adding small amounts (10 to 25 Gm) of carbohydrate, then of protein and fat, and increasing or decreasing the dose of Insulin, depending upon the presence or absence of glycosuria The diet is finally brought to the maintenance level according to the methods previously described

Whether or not the immediate use of Insulin is decided upon, the patient should collect the next day's urine and bring it or send it for examination Unless specifically instructed, he will often save a specimen of the urine passed during only one period of the day, this single specimen may happen to be sugar-free, in contrast to the urine passed during the other periods Hence, twenty-four-hour specimens of urine, or samples passed during specified periods, must be insisted upon

In some cases, a sugar-free urine cannot be obtained while the patient is on an adequate maintenance diet unless Insulin is used, in others, the doses of Insulin used during the first days of treatment will need to be reduced If it is decided to begin the use of Insulin at once, the patient is instructed to obtain a vial of Insulin of U-40 concentration (because this concentration lends itself best to average circumstances), an appropriate syringe graduated in units or fractions of a cubic centimeter, some cotton, and a bottle of iso-propyl alcohol When practicable, the first few doses of Insulin may be administered by the physician or nurse The patient or a member of his household soon learns how to measure the dose in units and to give the injection aseptically

NUMBER AND TIME OF DOSES

Mild diabetics, who excrete sugar chiefly in the morning, may frequently be controlled with a single dose of Insulin given before breakfast The dose upon beginning treatment may be 5 units, which is increased by 3 to 5 units every day or two until the urine becomes sugar-free Should glycosuria persist after the dose reaches 20 [illegible]

doses daily Five to 10 units may be given before breakfast and dinner and these amounts may be increased daily, or every two days, by 3 to 5 units until the urine is rendered sugar free or doses have been increased to 20 to 30 units Should glycosuria still persist, a dose at noon may be instituted, and sometimes a dose at night

is necessary in order to prevent high blood sugar levels and glycosuria during the early morning hours The relatively short action of Insulin has been a disadvantage in severe cases, inasmuch as several doses daily may be required, a difficulty that led to the evolution and development of Protamine Zinc Insulin

METHODS OF MANAGEMENT WITH PROTAMINE ZINC INSULIN

The most satisfactory time for injection of Protamine Zinc Insulin, either accompanied or unaccompanied by treatment with unmodified Insulin, is usually before breakfast in the morning *Each case requires individual management* In many instances a period of careful observation under laboratory control, with frequent blood sugar estimations and urine examinations, will be required before a proper readjustment *of the blood-sugar level can be satisfactorily accomplished It is important for* the clinician to realize that a period of several days may elapse before the full therapeutic effect of Protamine Zinc Insulin is evident, and that unless the diabetic condition is kept under control during this period with small supplementary doses of unmodified Insulin, temporary glycosuria and hyperglycemia may supervene Too rapid increase in doses of Protamine Zinc Insulin during this initial period may result in a period of prolonged hypoglycemia Treatment must obviously be directed with the understanding that the final result will not be apparent for from two to three or more days, and in severe cases a few weeks may pass before entirely satisfactory readjustment is attained

1 Evening Administration—This method has been employed in severe cases of diabetes which require nocturnal injections of unmodified Insulin and in which one wishes merely to avoid rise in blood sugar levels during the night, rather than to limit injections to single doses of Protamine Zinc Insulin daily It has never attained much popularity in the United States In employing this method, the injection of Protamine Zinc Insulin may be given before supper or in the evening The number of units given in the evening dose of Protamine Zinc Insulin should in general be *approximately equal to the number of units of unmodified Insulin* that would be given at this time, and may include, in addition, as many units as would be given during the night were unmodified Insulin being used

If the patient continues to show glycosuria before breakfast, the dose of Protamine Zinc Insulin should be increased by from 3 to 5 units every second or *third day until the urine becomes sugar-free* or merely shows a trace on arising in the morning or one-half hour later

2. Morning Administration—The injection of Protamine Zinc Insulin before breakfast, followed or accompanied by a separate small dose of unmodified Insulin

in those severe cases which require it, is the method most favored in the United States Campbell Fletcher, and Kerr, and Wilder pointed out the advantages of this course, which Joslin and his associates and many others have also found efficacious

(a) New Cases of Uncomplicated Diabetes—Use of Protamine Zinc Insulin in previously untreated cases is usually a simple matter One may begin with a dose of 10 units and increase this by 5 or 10 units each day or two until the total reaches 30 to 40 units, unless before that time it is evident that the urine specimens passed on arising in the morning or one half hour thereafter (fasting) are becoming sugar free If glycosuria is persistent after meals (postprandial), a separate injection of rapidly acting Insulin may then be given before breakfast at the same time as the injection of Protamine Zinc Insulin, beginning with 5 units as the dose of this separate injection and increasing this amount by 5 units each day Joslin seldom found it necessary to give supplementary doses of Insulin of more than 20 units or of Protamine Zinc Insulin of more than 40 units, in order to control the case In making the subsequent changes in dosage which are necessary every day or two during the early period of readjustment, tests of two specimens of urine are especially important the specimen at 11 a m , which reflects the dosage of unmodified Insulin, and the specimen obtained upon arising in the morning which reflects the dosage of Protamine Zinc Insulin Increases or decreases of the doses, as indicated by the character of these two tests, may be made in amounts of 5 to 10 or more units Determinations of blood sugar values upon arising, before lunch, and at 4 and 9 p m are helpful, although not indispensable Glycosuria after the evening meal usually disappears within a few days, until negligible amounts of sugar are wasted at this time

(b) Cases Previously Treated with Insulin—In long standing cases of diabetes previously treated with Insulin, the substitution of Protamine Zinc Insulin for unmodified Insulin may best be made by substituting for the entire requirement of Insulin one daily injection of Protamine Zinc Insulin consisting of about three fourths of the total number of units previously required Then, if glycosuria persists in the late forenoon or early afternoon readjustment of food intake or exercise is indicated, or a supplementary dose of unmodified Insulin may be given Here again, the dose of Protamine Zinc Insulin is regulated by the amount of sugar in the urine specimen obtained upon arising in the morning (fasting) or the second specimen one half hour later, whereas the dose of unmodified Insulin is adjusted according to the amount of sugar in the late morning or early afternoon specimens (postprandial) Aglycosuria upon arising in the morning precludes further additions to the dose of Protamine Zinc Insulin, otherwise reactions will occur during the early morning hours

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Often the amount of Protamine Zinc Insulin required is from about two thirds to equal the number of units in the patient s former total daily dose of unmodified Insulin During the first few days of substitution it is important to keep in mind that in this initial period doses of unmodified Insulin may be needed until the more deliberate, prolonged action of Protamine Zinc Insulin has become established In such instances, the injections of both Protamine Zinc Insulin and rapidly acting Insulin may be given at the same time but in different sites If sugar appears in the late forenoon or early afternoon, more unmodified Insulin is needed, but if the urine is sugar-free when the patient rises in the morning, the dose of Protamine Zinc Insulin may need diminution If sugar appears late in the day or is evident when the patient arises in the morning, the dose of Protamine Zinc Insulin should be increased If glycosuria continues during the night, the dose of Protamine Zinc Insulin should be increased at three day intervals until the urine becomes sugar free Too rapid increase of the dose may result in attacks of hypoglycemia which may be profound and prolonged To prevent the occurrence of reactions in patients who are "sugar free," it is advisable to determine their blood sugar levels at regular intervals and to reduce their doses of Protamine Zinc Insulin by from 3 to 5 units every few days as long as the urine remains sugar free or until the optimum dosage has been finally established From several days to a few weeks may be required for satisfactory readjustment For success in these cases patience is a requisite in exceptional instances even three to four months may be required for readjustment

There has been general agreement that diabetes of moderate severity, requiring for example, from 20 to 40 units of unmodified Insulin divided between two doses daily, can usually be controlled by giving a daily dose of from 20 to 40 units of Protamine Zinc Insulin in a single injection before breakfast

Insulin Mixtures—With the advent of NPH Insulin, which has a type of action which parallels the 2 1 mixture of regular and Protamine Zinc Insulin, these older mixtures can be abandoned in most cases NPH Insulin can be mixed with regular Insulin, when necessary, following the technic described on the following page

The admixture of Insulin and NPH Insulin is a technic that is easy to do but more difficult to explain *Patients must actually be shown* how to make their mixtures (Figure 3) The new feature to be learned is how to draw an air *bubble into* the syringe and roll it through to mix the doses The dose of Insulin is always drawn into the syringe first, then the NPH Insulin *up to the total* (so the patient does not have to calculate) Since all the daily doses are combined into one *injection*, the 80-unit per cc concentrations are usually preferable in order to lessen the volume

IGURE 3

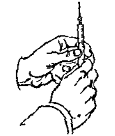
Technic of Preparing Admixtures of Insulin and NPH Insulin for Injection

1 Observing sterile precautions inject *volume* of air equal to dose into top of vial of NPH Insulin Withdraw needle Use 2 cc. syringe if total dose exceeds 1 cc.

2. Inject air and withdraw proper dose of Insulin from vial in usual manner

3 Invert vial of NPH Insulin several times Withdraw dose into syringe containing the Insulin

4 Holding syringe with needle upright draw air bubble into syringe invert as shown and roll bubble *through to mix*



5 Expel air bubble and inject in usual manner

Method

RECENT AND PREVIOUSLY UNTREATED CASES

I (a) FIRST DAY—10 UNITS NPH INSULIN
(b) INCREASE DAILY (by 3 to 5 units) until urine is nearly sugar free on arising (or B S approaches normal)

II (a) IF GLYCOSURIA/HYPERGLYCEMIA PERSISTS BEFORE BREAKFAST (with satisfactory daytime levels) Add smaller dose (20%±) of NPH Insulin before evening meal
(b) IF POST-BREAKFAST GLYCOSURIA/HYPERGLYCEMIA Mix Insulin with NPH Insulin (dose by trial) or supplement with separate morning Insulin

III DIETARY READJUSTMENT
(a) IF MORNING HYPERGLYCEMIA Reduce breakfast to 1/5 daily total
(b) IF UNUSUAL EXERCISE or long interval between meals ANTICIPATE HYPOGLYCEMIA by extra food
(c) YOUNG CHILDREN—between meal snacks

INSULIN TREATED CASES

I (a) REGULAR INSULIN Add total units—replace with same total of NPH Insulin (Expect some glycosuria first day or two—supplement if necessary)
(b) PROTAMINE ZINC INSULIN—(and supplementary Insulin) replace total with 10 to 20 percent fewer units of NPH Insulin first day Then increase dose as necessary
(c) MIXTURES OR GLOBIN ZINC INSULIN Substitute NPH Insulin in same dose

INDIVIDUAL MANAGEMENT IS ALWAYS ESSENTIAL

Preparations of the same manufacturer should be used in order to keep conditions as constant as possible

DIETARY READJUSTMENTS

When using long-acting Insulins, just as when using unmodified Insulin, regulation of the diet is a factor of fundamental importance, but certain differences appear essential to success with the modified product

Although in mild cases no difficulty is ordinarily encountered, in the severely diabetic patient intensive and individual study may be necessary before successful rearrangement of the diet can be accomplished The long acting Insulins exert their effect much more continuously than does unmodified Insulin Hence the carbohydrate of the meals following an injection of these Insulins should in most cases be reduced somewhat with a view to avoiding hyperglycemia and spreading the metabolic load over a longer period *In most cases there may be occasion for*

special readjustments of diet to be made temporarily as outlined in the section of this book headed "Treatment of Hypoglycemia" (see page 56) In any event, each case must be treated individually, and success in many instances will depend upon skillful balancing of diet in relation to prolonged and more or less continuous Insulin effect, rather than upon adjustment of Insulin dosage with respect to individual meals, such as is made when unmodified Insulin is being used The necessity for providing small feedings between meals and a lunch at bedtime, consisting of carbohydrate and especially protein to supply available carbohydrate over the several hours of the night period when food is not taken, has now been generally recognized and is firmly established in clinical practice When Protamine Zinc Insulin is employed, these supplementary feedings at bedtime are especially important in order to prevent Insulin reactions in the early morning hours Scott states "Not only do these extra feedings prevent Insulin reactions, but, by stimulating the glucose metabolizing apparatus of the body, they enable the body to handle the following meals more effectively " The appearance of a sugar free urine before breakfast, accompanied by normoglycemic blood-sugar levels in the fasting condition, precludes increases in the dose of Protamine Zinc Insulin and usually calls for a slight reduction Hypoglycemia at any time of day is an obvious indication for revision of dosage or dietary arrangement

METHODS OF MANAGEMENT WITH NPH INSULIN

The most satisfactory time for injection of NPH Insulin is usually before breakfast in the morning Each case requires individual management In many instances, a period of careful observation under laboratory control with frequent blood-sugar estimations and urine examinations will be required before a proper readjustment of the blood sugar level can be satisfactorily accomplished The number and size of daily doses, time of administration, diet, and exercise are problems that require direct and continuous medical supervision

In the newly developed, uncomplicated case of average severity the dose of NPH Insulin may be 10 units before breakfast in the morning, and this is increased every day by 3 to 5 units until satisfactory readjustment is established, as determined by blood-sugar levels and freedom from glycosuria In patients who are already being treated with Protamine Zinc Insulin, unmodified Insulin, or both, one may begin with slightly fewer total units than have been required under previous management (about 20 percent less), then increase the dose if necessary

NPH Insulin can be substituted quite readily for 2 1 mixtures of Insulin and Protamine Zinc Insulin, since the activity of NPH Insulin closely approximates such a mixture Direct substitution, unit for unit, is made, and no change in the over-all management is to be anticipated

Occasionally a quicker-acting element may be necessary to control the postprandial (after-breakfast) elevation in blood sugar NPH Insulin, because of its crystalline composition, does not combine readily with added unmodified Insulin, therefore, NPH Insulin with an amount of unmodified Insulin added to make a syringe mixture has an activity similar to separate doses of NPH Insulin and unmodified Insulin

When using NPH Insulin, just as when using any Insulin preparation, regulation of diet is a factor of fundamental importance In any event, each case has to be treated individually, and success will depend upon skillful balancing of diet in relation to the prolonged Insulin effect. In certain of the more severe cases, there may be some advantage in prescribing a smaller breakfast and larger noon meal, just as is done with Protamine Zinc Insulin and Globin Zinc Insulin In such instances, the proportional distribution of food is usually 1/5, 2/5, and 2/5 for the several meals

Bermúdez and Zabaleta found NPH Insulin perfectly satisfactory when the total daily food intake was divided into 1/4, 1/2, and 1/4 Paniagua and Domínguez stress that the breakfast should contain at least or slightly more than 1/5 of the total daily carbohydrate intake

HYPOGLYCEMIA

DEFINITION

Hypoglycemia is a term used to describe the condition that results when the blood sugar falls below the normal level Symptoms may not appear until the blood sugar is 0 07 percent (70 mg per 100 cc), or even lower if the patient has been taking the long acting Insulins

In recent years, spontaneous hypoglycemia has come to be recognized as a clinical entity which may occur in the nondiabetic as a result of overproduction of endogenous insulin (functional or organic disease of the pancreas), inhibition of the action of physiological insulin antagonists (adrenal, thyroid, or pituitary insufficiency), exercise or other factors which influence glycogen storage, inadequate ingestion (omission of a meal), or, finally, excessive elimination (renal diabetes) of dextrose

HYPOGLYCEMIA DUE TO INSULIN

As a cause of hypoglycemia in the diabetic, undernutrition has been replaced by Insulin, and the terms "Insulin shock" and "Insulin reaction" have been introduced

The development of Insulin hypoglycemia is proof positive of an imbalance between the factors that tend to reduce and those that tend to elevate the level of the blood sugar These factors have previously been mentioned Some of them such as diet *Insulin and exercise are clinically easily estimated and controlled others* (for example endocrine and nervous influences) are only indirectly measurable and are not always easily controlled Fortunately Insulin hypoglycemia does not ordinarily occur once the appropriate diet and dose of Insulin have been deter m ned and are maintained although improved carbohydrate tolerance in the early period of treatment necessitates frequent readjustments

Obviously, however hypoglycemia may occur even though the Insulin dosage remains constant if the usual supply of available dextrose is reduced by erroneous d etetic estimation omission of a meal loss of ingested food by vomiting or diarrhea or delayed digestion Exercise though of therapeutic value because of its Insulin sparing action if more strenuous than usual may precipitate hypo glycemia On the other hand an actual increase of Insulin may be mistakenly ad ministered because of an error in measuring the dose or an increased dosage wh ch may have been temporarily necessary during an emergency may become excess ve when the patient s carbohydrate tolerance improves as conditions return more nearly to normal

In the presence of certain types of heart disease notably angina pectoris and *coronary sclerosis hypoglycemia takes on an added significance because the heart* muscle like other muscles requires an adequate supply of sugar Insulin is not contraindicated in such cases indeed may be of utmost value but special care must be exercised to provide an adequate diet and to avoid doses large enough to produce hypoglycemia In the elderly the arteriosclerotic and those patients hav ing cardiac complications sudden reduction of the blood sugar is particularly to be avoided

SYMPTOMS AND SIGNS OF HYPOGLYCEMIA

An Insulin reaction may come on shortly after the administrat on of Insulin or it may be delayed for many hours particularly in patients taking the long acting Insulins in the latter event it is most common during the early morning hours The dominant symptoms which follow overdoses of Insulin are acute hunger sud den weakness sweating and nervousness with or without tremor In patients taking long acting Insulins the characteristic early symptoms are more likely to be head ache drowsiness and malaise Later findings which follow an overdose of either type of preparation are emotional and mental disturbances such as anxiety laugh ing or crying *confusion and aphasia or delirium muscle in-co ordination with* staggering vertigo d plopia and convulsions unconsciousness and in neglected

cases, death It is not unheard of for a diabetic to be arrested and locked up by police on suspicion of alcoholism when he is actually experiencing the mental aberration and ataxia resulting from hypoglycemia If the error is not promptly recognized and treated, irreparable damage may result

At least part of the urine in the bladder may have accumulated before hypoglycemia developed, and the first urine specimen that is obtained may therefore disclose a "residual" glycosuria The second specimen will be sugar-free See *Table V, page 70, for important points of differential diagnosis*

TREATMENT OF HYPOGLYCEMIA

Prevention of Insulin *reactions is important, and the lines along which to proceed* are obvious from what has been said concerning causes If the patient understands the predisposing factors, knows the early symptoms, and at all times carries a few lumps of sugar or pieces of candy, he can ordinarily avert the condition, because the administration of carbohydrate in the early stages is very effective Sweetened fruit juices and syrup are also efficient antidotes The presence of diarrhea or vomiting makes careful judgment essential, because these conditions themselves predispose to hypoglycemia, but they may be associated with infection, which necessitates giving an increased quantity of Insulin Close supervision of the dia-

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that at least one of the diabetic child's playmates serve as a sort of guardian When there is temporary need for larger doses of Insulin, as in coma, during surgery, or in other emergencies, small doses more frequently repeated are preferable to larger doses given less often

Although the use of the protamine modifications of Insulin has reduced the frequency of occurrence of symptoms of hypoglycemia, it must be emphasized that *hypoglycemic reactions occur and may endure for considerable periods* The decline of the blood-sugar level under the influence of the protamine modifications of Insulin may occasionally be so gradual that marked hypoglycemia is produced without apparent symptoms or discomfort to the patient Such reactions usually can be prevented if daily urine examinations are made and the dose is appropriately reduced by two or three units every day or two when the early morning specimen is negative for sugar

The treatment of hypoglycemia, whether due to Insulin, Protamine Zinc Insulin, or NPH Insulin, is the same *The antidote is sugar* Since a hypoglycemic reaction during treatment with Protamine Zinc Insulin or NPH Insulin may be

not only prolonged but also recurrent in nature, it is advisable to give both a soluble and a slowly digestible carbohydrate in treating the patient (for example corn syrup or honey, with bread) As an alternative and even though the patient may *appear* to be restored to normal through receiving a soluble carbohydrate food such as orange juice, sugar, candy dextrose corn syrup or honey it is important to provide *additional* carbohydrate after the lapse of one or two hours This additional carbohydrate may be provided advantageously in the form of a glass of milk and some crackers If it is temporarily impossible for carbohydrate to be given by mouth or if the patient is in a critical condition from 10 to 20 Gm of dextrose should be slowly administered intravenously followed later by food or by repeated injections of dextrose as indicated by frequent laboratory estimation of the blood sugar level In severe and prolonged reactions it may be necessary to give repeated injections of dextrose intravenously over periods of several hours

THERAPEUTIC VALUE OF EXERCISE

Although of general efficacy in the treatment of many chronic diseases exercise is of specific value in diabetes because it promotes the utilization of carbohydrate diminishes the requirement for Insulin and improves the circulation thereby lessening the tendency toward arteriosclerotic complications Exercise is a useful supplement to diet and Insulin but like the two latter agents it needs to be regulated because if strenuous on one occasion and mild on another it may cause undesirable fluctuations in the blood sugar level If more than the usual amount of exercise is contemplated it may be desirable to reduce or omit the preceding dose of Insulin or provide for the ingestion of additional food The latter measure is of great importance in patients taking Protamine Zinc Insulin or NPH Insulin since obviously the prolonged effect of these preparations makes it impractical to make quickly effective readjustments in the dose The effect of exercise in lowering the blood sugar level must therefore be anticipated in such cases by the provision of extra food prior to indulgence in exercise An extra slice of bread at the previous meal or even a few soda crackers which may be carried in the pocket and munched as the occasion warrants may serve to prevent an undue lowering of the blood sugar level from exercise and the occurrence of undesirable hypoglycemia

DIABETES IN CHILDHOOD

Before the discovery of Insulin a diabetic child had an average duration of life of 2 4 years Since the discovery of Insulin however life expectancy has been multiplied manyfold and deaths because of diabetes have practically ceased to occur Since diabetic children do not die today from diabetes there is an increasing number of them alive to be treated The use of NPH Insulin or Protamine Zinc Insulin

on account of their prolonged effect, should protect the lives and tissues of these young patients even better, so that the promotion of normal rates of growth and development can be assured and deficiency diseases and premature senility be more nearly prevented Joslin's statistics (1944) bear this out, they show that the average age of diabetic patients at death has already advanced from sixty-two to sixty-four years since long-acting Insulins came into general use

Diabetes in infants under one year of age is infrequent, and congenital diabetes is almost unknown A hereditary tendency toward development of the disease is often apparent, however, and can frequently be found if sought for carefully *Treatment of diabetes in infants and children rests upon the same general* principles which underlie treatment of the adult diabetic

The fundamental characteristics of juvenile diabetes which differentiate it *from the adult type are its* severity, rapid progression, lability, and tendency toward sudden development of complications Mildness of the disease is the rule during the first year after its onset, but this is followed by the gradual development and increasing intensity of nocturnal hyperglycemia, thus, when stabilization finally occurs, as it usually does in the fourth or fifth year, the level of the fasting blood sugar is four or five times that of the normal person

The mortality rates of the pre-Insulin era and the complications of the survivors of this period long ago answered in the affirmative the following question Should Insulin be used in the treatment of juvenile diabetes? All diabetic children require Insulin, preferably continuously from the day of onset of the disease

Multiple injections of unmodified Insulin, before meals and frequently at 10 p m and at 2 or 3 a m , were formerly required in order to eliminate peak levels in the twenty-four-hour blood sugar curve and to prevent the occurrence of nocturnal hyperglycemia *The inconvenience of such frequent hypodermic injections* and the danger of provoking hypoglycemia at night usually resulted in the omission of some doses, so that under the old regimen juvenile diabetes was well controlled for only relatively few of the twenty-four hours *Protamine Zinc Insulin has been* of great value in obtaining better control in these patients, but the lability of the disease in children is such that care must still be exercised in order to prevent the occurrence of hypoglycemia For this reason the standard of control at the Baker Clinic, based upon the twenty-four-hour quantitative excretion of urine, has not been continued at 100 percent aglycosuria but at 90 percent Most clinicians consider that the presence of a small amount of sugar in the urine of the diabetic child each day is not harmful or, at any rate, is preferable to the production of frequent hypoglycemic reactions

White, Montagna, and Saldún de Rodríguez found NPH Insulin suitable for the control of diabetes in childhood and adolescence

THE DIET

In Infancy—Treatment of diabetes in infancy is not so difficult as might be expected Dietetic requirements are easily satisfied with milk, cereal, orange juice, and well-cooked vegetables The attention given by the average mother today to feeding her normal baby makes it a relatively simple matter to institute the few changes necessary in the feeding of a diabetic baby Regularity in feeding and attention to the quality and quantity of food taken, which are essentially normal, are the chief requirements

For the occasional case of diabetes occurring during the first year of life, a diet suitable for a normal infant may be given the diabetic infant There are a number of commercial brands of cooked wheat cereal that may be employed, cooked either with water or with some of the whole milk of the diet The vegetables given may be string beans, carrots, spinach, peas, tomatoes, cabbage, cauliflower or others They should be well cooked, preferably strained or mashed, and the water used in cooking should be saved in order to conserve minerals and vitamins

Insulin must be given to all infants as well as older children with diabetes The daily dose for children under four years of age usually will be found to vary from 10 to 20 units

In Childhood—The caloric allotment for an adult must be adequate for basal metabolism plus muscular activity For the child it must be adequate for basal metabolism plus muscular activity *plus growth* Therefore, the number of calories allowed per kilogram of body weight is greater for the child than for the adult

The number of calories required, though dependent upon surface area, closely parallels the age of the child (White) For simplicity, one may prescribe calories by age 1,000 at age one, and an additional 100 per year of age until completion of growth and development, as shown in the table on the following page

The protein requirement ranges from 1 5 to 3 Gm per kilogram per day As full growth is attained, the protein requirement is reduced to that of an adult

In White's diets the ratios of carbohydrate, protein, and fat have remained approximately 2 to 0 9 to 1

Some sample menus for ages two, four, six, ten, and fifteen will be found on pages 117–121 From these diets, 5, 10, 15, or 20 Gm of carbohydrate may be subtracted and taken at 10 30 a m , 3 30 p m , and 10 p m , and the total carbohydrate for the three major meals is then divided into equivalent thirds The small meals are particularly important when Protamine Zinc Insulin is used

Age	*Total Calories*
1 year	1 000
2 years	1,100
3 years	1 200
4 years	1,300
5 years	1,400
6 years	1,500
7 years	1,600
8 years	1,700
9 years	1,800
10 years	1,900
11 years	2,000
12 years	2 100
13 years	2 200
14 years	2 300
15 years	2 400

The diet of the three-year-old child may contain milk, butter, cream, cereals, bread, soups, eggs, meat, vegetables, and fruit Milk is a necessary part of the child's diet in amounts varying from a pint to a quart daily If more milk is desired in the menu, one may add 100 Gm whole milk and subtract one-half egg or 15 Gm meat, one third slice of bread (10 Gm), and 1 Gm butter Cod liver oil may be substituted for part of the butter Approximately 1 teaspoonful (4 Gm) of cod liver oil is equivalent in fat content to 5 Gm of butter Bread is usually dried or toasted, or crackers may be substituted Whole-wheat bread is preferred to white bread because of its vitamin content, but as far as carbohydrate, protein, and fat content is concerned, the two kinds are practically equal Candy, cake, pie, and other sweets should, of course, be omitted

MANAGEMENT OF DIABETES IN CHILDHOOD

Whenever possible, it is desirable to hospitalize the patient for adjustment The majority of new patients can be treated with NPH Insulin or Protamine Zinc Insulin, often without supplementary doses of unmodified Insulin, but if it is preferred, one can first free the patient from sugar with unmodified Insulin by collecting two-hour or four-hour urine specimens for qualitative tests and giving Insulin as required to render the patient sugar-free Small doses of 2 to 5 units of Insulin, increased gradually if necessary and given at intervals of four hours, will usually be sufficient

The convenience and comfort of giving all injections at the same time in the morning have made the long-acting Insulins valuable to the patient, and in addition, even if supplementary doses of unmodified Insulin are required, the noc-

turnal hyperglycemia which has been characteristic of diabetes in childhood can be prevented For the newly developed juvenile diabetic, dosage is based upon the age of the patient Under five years of age 10 units, between five and ten years 20 units, and between the ages of ten and fifteen years 30 units are given twenty minutes before breakfast Adjustments may be made at three-day intervals The dose of the long-acting Insulin is increased by 2 to 4 units every day or two until the fasting specimen of urine or sample of blood sugar is normal Then, to avoid cumulative action and hypoglycemia, the dose is decreased by 2 or 4 units until the urine specimen obtained before breakfast is green when tested with Benedict's solution, or until the blood-sugar level has reached the upper limit of normal

In long-standing cases of juvenile diabetes in which Protamine Zinc Insulin is used, the patient is treated with 2 units of Protamine Zinc Insulin for 1 unit of unmodified Insulin, the doses being given separately but at the same time If a mixture is employed, the proportion of the two will be reversed White continues the same morning dose of unmodified Insulin, provided it is 20 units or less, and in addition the patient is given twice as many units of Protamine Zinc Insulin The dose of Protamine Zinc Insulin is increased every two or three days until the fasting blood sugar level or urine specimen becomes normal The dose of rapidly acting Insulin is then reduced 4 units at a time and maintained at that level which controls the late morning and afternoon specimens of blood or urine Only the milder cases are treated with Protamine Zinc Insulin alone

NPH Insulin has shown quite satisfactory results in the treatment of diabetes in children White reported that, in 95 percent of a group studied, results obtained with NPH Insulin were comparable to those following separate injections of unmodified Insulin (crystalline) and Protamine Zinc Insulin and in some cases NPH Insulin was the more effective The dosage of NPH Insulin in children is determined in the same manner as is the dosage in adults

The most common time for hypoglycemic reactions to occur is in the early morning hours Their severity is due to the fact that the patient, during sleep, has failed to recognize such warning symptoms as headache, nausea, and malaise The treatment is the same as that given for Insulin reactions following injections of Insulin Glucose is administered intravenously, and slow recovery is the rule

INSULIN ALLERGY

Insulin is a typical protein and may under certain circumstances act as an antigen In occasional cases, localized anaphylactic phenomena develop about the site of injection Less frequently, hypersensitiveness is manifested by urticaria or even constitutional symptoms

from hour to hour or from day to day Some of the most common factors which alter Insulin dosage are the following

Those increasing the need for Insulin	*Those diminishing the need for Insulin*
Gain in weight	Reduction in weight (therapeutic)
Increased diet	Reduced diet
Muscular inactivity	Increased exercise
Pregnancy	Delivery
Various therapies	Termination of therapies
Thyroid Pituitary	Thyroid Pituitary
Epinephrine Deep roentgen ray	Epinephrine Deep roentgen ray
Endocrine disturbances	Correction of endocrine disturbances
Toxemias	Correction of toxemias
Hyperthyroidism Sepsis	Hyperthyroidism Sepsis
Acute infections	Termination of acute infections
Fever	Absence of fever
Ketosis (acidosis)	Correction of ketosis (acidosis)
Burns, e g , ultraviolet (sunburn)	Healing of burns
Allergy	Correction of allergy
Injections into same site (tumefactions)	Injections into fresh site
Destructive process in pancreas	
Disturbances in liver function	Improvement in liver function
Cardiac decompensation	Correction of cardiac decompensation

mand for adequate glycogen storage and carbohydrate combustion The carbohydrate content of the diet should not be greatly restricted if at all but it may need to be supplied in liquid form The total daily requirement for Insulin will generally need to be increased and smaller individual doses may be given at more frequent intervals Acidosis and coma are especially prone to occur in the young diabetic or in any diabetic during the first years of the disease

Omission of Insulin—Obviously if a diabetic needs Insulin to permit him to take a diet large enough to support healthful living omission of Insulin invites trouble unless simultaneous dietetic restrictions are made In the presence of gastro intestinal disturbances especially when accompanied by diarrhea vomiting and reduction of food intake (as after surgery or seasickness) the Insulin dosage may need to be reduced Insulin should never be omitted under these circumstances unless the urine remains sugar free In the presence of an infection even though food intake is materially reduced Insulin should not be omitted on the contrary, a very much larger quantity may be required

Infection—Infection exaggerates the severity of diabetes and in the untreated or improperly treated diabetic frequently precipitates coma It temporarily reduces carbohydrate tolerance makes larger doses of Insulin necessary and converts a mild diabetic into a severe one *If a diabetic whose urine has been kept sugar free by proper treatment begins to have glycosuria on the same diet and dose of Insulin the physician should immediately search for an infectious process even though the thermometer reveals the absence of fever*

A trifling coryza may endanger the diabetic s life unless its potential importance in reducing carbohydrate tolerance is appreciated If an infection develops in a diabetic who is not taking Insulin treatment with Insulin is likely to become imperative at least for a time If an infection develops in a diabetic who is already taking Insulin it is almost certain that materially increased dosage will be necessary Two three or even four times the usual Insulin dose may be required during this emergency period and the interval between injections may need to be shortened

The urine should be examined several times daily not only for sugar but for diacetic acid as well Because the infectious process may begin to subside at any moment and the need for the additional Insulin therefore may rather suddenly disappear the diabetic with an infection demands more than the usual amount of supervision The carbohydrate content of the diet should not be restricted but the fat and protein components often may be reduced temporarily to advantage

SYMPTOMS AND DIAGNOSIS OF DIABETIC COMA

In order to avoid errors in diagnosis, it is essential to bear in mind that the diabetic is subject to any and all of the diseases that may befall a normal person (be they acute or chronic), infections, injuries, accidents, or intoxications A diabetic may be unconscious from a fractured skull, from drugs or alcohol, from a cerebral hemorrhage, or from meningitis, or he may be in actual shock All these and many other *abnormal stimuli* are capable of producing profound alterations in carbohydrate metabolism

The early symptoms of diabetic coma are notoriously vague and deceptive Acidosis should therefore be suspected whenever any unusual symptom or sign makes its appearance in a known diabetic patient *Among the more frequent early* symptoms are weakness, headache, thirst, loss of appetite, vomiting, drowsiness, pains in the legs, back, or abdomen, and, subsequently, dehydration, deep breathing (Kussmaul), somnolence, and coma The respirations later may become irregular and shallow

The appearance of the patient is usually characteristic The cheeks are flushed, respirations are deep, the skin and mouth are dry, and the eyeballs are soft Frequently, gastric distention is evident and can be demonstrated by physical signs The characteristic odor of acetone on the breath may pervade the entire room

Diagnosis should be verified by examination of the urine and, *if possible, of* the blood The urine almost invariably contains large quantities of sugar and gives *a strongly positive test for diacetic acid with ferric chloride* (page 152) Definite symptoms begin when the carbon-dioxide combining power of the blood is reduced below forty volumes percent and are generally marked if it falls below twenty volumes percent One should not be deceived by the presence of albumin and casts in the urine, since both occur with regularity in diabetic acidosis Leukocytosis is the rule, and when it occurs in connection with abdominal pain, it may lead to the suspicion that the patient has appendicitis Under such circumstances a few hours' intensive treatment of the acidosis will usually settle the question, because the abdominal symptoms disappear with the elimination of the acidosis The most important points in differential diagnosis of these *conditions have been summarized* by John and are given in Table IV

Occasionally, uncertainty may exist in differentiating between diabetic coma and Insulin reaction The symptoms of the latter ordinarily are not confusing except that some patients taking Protamine Zinc Insulin may not perspire and may develop headache, malaise, nausea, and vomiting if a prolonged period of hypoglycemia has been induced Table V (page 70) will be helpful in making a diagnosis under such circumstances

TABLE IV • *Differentiation between Diabetic Acidosis and Appendicitis*
(After John)

Symptoms	Acidosis	Appendicitis
Vomiting	Precedes onset of pain	Follows pain
Fever	May or may not be present	May or may not be present
Leukocytosis	Usually high from dehydration and blood concentration	Usually high and may be significant
Pain	Relieved upon control of acidosis	Symptoms do not abate with treatment of acidosis

TREATMENT OF DIABETIC COMA

Diabetic coma is a first rank medical emergency It represents an acute Insulin deficiency whether this is actual or relative and Insulin is the *sine qua non* of its treatment Root states Insulin cures coma because it enables the body to utilize glucose present in the blood and fluids of the tissues It restores glycogen depots and provides energy for the body by oxidation of carbohydrate instead of fat and so stops excessive ketone production Joslin attributes his favorable results in a series of cases at the Baker Clinic (2 deaths in 123 consecutive cases) to (1) earlier recognition of cases of coma by the referring physician and (2) more rapid administration of larger doses of Insulin during the first three hours of treatment *It is the Insulin given early in treatment that counts most heavily* Thus the average doses in the first three hours of treatment have increased as experience accumulated and this increase is accompanied by a decline in mortality Whereas in an earlier series the Boston workers gave 83 units during the first three hours by 1932 1934 they were giving 136 units and in the most recent series (1940 1946) this average had risen to 215 units In a critical case the treatment given during the first three hours will spell the difference between life and death

The fundamental principles of treatment of diabetic coma are to give sufficient Insulin to restore normal carbohydrate metabolism and to combat dehydration and attendant circulatory shock by giving sufficient fluid containing electrolytes in amounts adequate to restore blood volume and electrolyte balance Each case is an individual problem and the amount of Insulin required may range from 30 units to over 1 000 units As a rule 4 000 to 5 000 cc of isotonic salt solution have been ample in Root s experience but in exceptional cases 8 000 cc or more of fluid have been administered in the first twenty four hours Very aggressive treatment is indicated in patients having a history of prolonged acidosis and repeated vomiting soft eyeballs dry cold and mottled skin rectal temperature below 97°F systolic blood pressure below 90 mm of mercury gastric dilatation and diminishing urinary secretions Such cases are indicated by findings of a

TABLE V • *Differential Diagnosis of Diabetic Coma and Insulin Reactions*
(Modified from Joslin)

	Clinical Features		
	Diabetic Coma	Insulin Reaction	Protamine Zinc Insulin or NPH Insulin Reaction
Onset	Slow—days	Sudden—minutes	Gradual—hours
Causes	Ignorance and neglect Intercurrent disease	Overdosage Delayed or omitted meals Excessive exercise before meals	Overdosage Delayed or omitted meals Excessive exercise before meals
Symptoms	Thirst Headache Nausea Vomiting Abdominal pain Dim vision Constipation Dyspnea	Inward nervousness Weakness Sweating Hunger Diplopia, blurred vision Paresthesia Psychopathic behavior Stupor, convulsions	Fatigue Weakness Headache *Sweating sometimes absent* Dizziness Nausea Diplopia, blurred vision Paresthesia Psychopathic behavior Stupor, convulsions
Signs	Flushed face Air hunger *Kussmaul breathing* Finally respiratory paralysis Dehydration—dry skin Rapid pulse *Soft eyeballs* Acetone breath Normal or absent reflexes	Pallor Shallow respiration Sweating Pulse normal *Eyeballs normal* Babinski reflex often present	Pallor Shallow respiration Skin may be dry Not characteristic *Eyeballs normal* Babinski reflex often present
	Chemical Features		
Urine			
Sugar	Positive	Usually absent, especially in second voided specimen	Usually absent, especially in second voided specimen
Acetone	Positive	Negative	Negative
Diacetic acid	Positive	*Negative*	*Negative*
Blood			
Leukocytosis	Present, may be very high		
Sugar	350± mg	60 mg or lower	60 mg or lower
CO_2 combining power	Less than 20 volumes percent	Usually normal	Usually normal
Response to	Slow	Rapid, occasionally delayed	May be delayed

carbon dioxide combining power below ten volumes percent and a blood-sugar level of over 700 mg Too much emphasis cannot be placed upon the necessity of considering each case as a separate problem in management The response to initial treatment must serve as a guide to the intensity with which further treatment will need to be pursued during the next few hours

The patient in coma should be treated in the hospital, although a preliminary dose of 20 to 40 units of Insulin, or more, should be given when the diagnosis is made Preparations for receiving the patient should be completed in *the hospital prior to arrival Salt and dextrose solutions for parenteral injection,* Insulin, and a laboratory technician should be instantly available Blood-sugar and carbon dioxide estimations are begun at once, and an intravenous infusion of 1,000 cc saline is started immediately In general, treatment may be carried out along the following lines

Insulin—Since rapid action is desirable in treatment of coma, the Insulin used should be a preparation of amorphous or crystalline type Because of its slow, prolonged effect, Wilder has suggested Protamine Zinc Insulin as an adjunct to treatment, an initial dose of 50 units or thereabouts serving to bridge over the gaps in effect between doses of unmodified Insulin After this preliminary dose, treatment is carried out just as though Protamine Zinc Insulin had not been used

The more profound the coma, the greater the dose of Insulin required, therefore, the first dose may vary from 20 to 100 units, depending upon the age of the patient, duration and severity of the coma, and previous Insulin administration This dose should be repeated at intervals of thirty to sixty minutes until there is clinical and laboratory evidence of improvement Scott suggests an initial dose consisting of 1 unit of Insulin per kilogram of body weight

If hospital or laboratory facilities are not available, treatment can still be successfully carried out and regulated by means of the qualitative Benedict test Urine specimens should be tested every one-half to two hours, and the dose of Insulin may then be determined according to the color of the test, thus

Red (++++), 20 units
Orange (+++), 15 units
Yellow (++), 10 units
Green (+), 5 units
Blue, 2 to 4 oz orange juice

Smaller doses should be given small children, and greater quantities are indicated if the response is not satisfactory The response of the patient during preceding hours must guide treatment for the immediate future

This method is only an approximate one By applying a quantitative procedure such as the Sheftel method, the actual number of grams excreted in each specimen may be calculated and the dose of Insulin given accordingly

Electrolytes—

Isotonic Sodium Chloride Solution—On the average, a total of 4,000 to 5,000 cc of fluid, given by the oral, subcutaneous, and intravenous routes, will be sufficient for the first twenty four hours

An initial intravenous infusion of 1,000 cc saline may be given fairly rapidly and should be followed by additional fluids by mouth, by hypodermoclysis, and by proctoclysis

Restoration of the electrolyte balance of the patient in coma is an essential factor in prevention of circulatory collapse and shock Large volumes of saline are sometimes required, even up to 10 percent of body weight Hypertonic solutions (50 cc of 10 percent saline, repeated if necessary) are sometimes used in desperate cases to overcome anuria

Potassium—It has been established that many patients have died during active treatment of diabetic coma, not from the complications of acidosis but from potassium deficiency In the past, potassium deficiencies have been overlooked primarily because their clinical signs have not been recognized A second difficulty has been the lack of adequate testing procedures to aid in the diagnosis

Several factors may be operative in the production of potassium deficiency during diabetic coma The primary cause is the depletion of potassium through ketonuria and polyuria The deficiency syndrome may, however, be precipitated by the treatment which is absolutely necessary for correction of the acidosis Insulin will lower potassium levels even in normal subjects Large volumes of fluids containing sodium primarily, which are necessary to correct the dehydration and sodium lack, will decrease the potassium levels simply by dilution Other factors have also been suspected It has been stated, for instance, that the intravenous administration of glucose tends to increase the likelihood of hypopotassemia, however, recent data do not bear this out

The clinical syndrome of potassium deficiency in diabetic acidosis is mainly the result of muscular weakness It generally begins ten to twenty hours after the start of coma therapy The earliest and most prominent sign is usually difficulty in respiration There is restlessness and possibly disorientation After some hours general muscular weakness becomes evident

If potassium deficiency is suspected, additional corroborative evidence may be secured from the study of electrocardiographic tracings (perhaps the easiest and most available guide to both diagnosis and treatment of the deficiency)

Low serum-potassium levels are accompanied by characteristic changes in the ECG, consisting of (1) marked prolongation of the Q T interval and (2) depressed T waves Depression of the ST segment has also been described, but this change may not be due to potassium deficiency per se

Blood potassium values are determined by the flame photometer They are expressed in milliequivalents (mEq) * Normally these values lie between 4 0 and 5 5 mEq per liter Losses may be extreme during the course of diabetic coma and some data indicate that there are losses of at least 98 to 406 mEq of potassium This is equal to the potassium contained in 7 3 to 30 3 Gm of potassium chloride Potassium replacement therapy must be cautious because abnormal elevation of the potassium level can be dangerous Concentrations greater than 7 8 mEq will result in a fairly consistent pattern of ECG changes characterized by (1) elevated T waves (2) prolongation of the QRS complex and (3) loss of the P wave At higher concentrations (10 to 10 5 mEq) death may result from heart block and cardiac arrest During therapy a return of the serum potassium to normal levels may not be associated with immediate return of the ECG to normal therefore care should be taken to avoid too rapid replacement of the potassium ion

Therapy—If possible potassium should be administered by mouth However, those patients having the greatest need for potassium are usually the least able to take it by that route Consequently, intravenous administration may be required In many instances oral therapy can be accomplished by giving the patient orange juice, milk meat broth or meat juice Orange juice contains about 9 to 10 mEq of potassium in 200 cc of liquid (one glassful) milk 7 to 8 mEq and meat broth 12 to 14 mEq Meat juice is higher in potassium content and one preparation contains approximately 240 mEq in 200 cc This latter material must usually be diluted as much as tenfold before it can be given to the patient

The chief consideration in the intravenous use of potassium salts is to prevent a concentration of more than 6 or 7 mEq in the venous blood from reaching the heart If large fluid volumes are desired as is usually the case in the treatment of coma solutions containing 20 to 40 mEq of potassium may be administered at a rate of 5 to 10 cc per minute (approximately 2 to 3 Gm potassium per liter) A 1 percent solution of potassium chloride (1 Gm per 100 cc) is approximately isotonic When such a solution is added to another isotonic solution (regardless of volumes), the resulting mixture will be isotonic A simple method of maintaining

*A milliequivalent is a unit of measure of the comparative weights of different compounds elements or groups of ions which possess the same chemical value of reaction This unit can be determined from the weight in mg per liter by the following formula

$$\text{Milliequivalent} = \frac{\text{mg per liter}}{\text{atomic weight}} \times \text{valence}$$

For example a solution containing 39 1 mg of potassium per liter would contain 1 milliequivalent of this element, because the atomic weight of potassium is 39 1 and it has a valence of 1

isotonicity is to add 100 cc of distilled water for each gram of potassium chloride added

Dextrose—Both Wilder and Joslin refrain from giving dextrose at the onset of treatment Experience at the Baker Clinic indicates that it may be detrimental Later, after the initial hyperglycemic level has been reduced to about 200 mg, or the urine specimen begins to show green to blue when tested with Benedict s solution, which may occur while the acidosis is still severe, dextrose is indicated However, by this time it is often possible to begin feedings of orange juice or ginger ale Early feedings of orange juice and clear meat broth will help prevent hypo potassemia Approximately 300 Gm or more of carbohydrate will be required during the first twenty four hours, either by mouth or intravenously if glycogen stores of the body are to be returned to normal levels

Vitamins—The parenteral administration of large amounts of dextrose solutions and the use of large doses of Insulin in the treatment of the nutritionally depleted diabetic may precipitate severe acute vitamin deficiencies (Sydenstricker), which are evidenced clinically by 'toxic states" After four or five days of such treatment edema, tachycardia, neuritic pain, tenderness over nerve trunks, motor weakness, and delirium are not infrequent Such patients have undergone a great increase in their utilization of carbohydrate, and their scanty stores of thiamin, riboflavin, and nicotinic acid are rapidly exhausted

In order to prevent acute deficiencies of this type, each infusion of dextrose (25 to 50 Gm) may well include 5 to 10 mg of thiamin, 2 to 3 mg of riboflavin, and 50 to 100 mg of nicotinamide As an alternative, some observers recommend the separate injection intramuscularly of similar amounts of pure fractions in cluded in crude liver extract or other preparations yielding adequate amounts of the whole B complex

Alkalies—Clinical opinion has differed concerning the value of alkalies in the treatment of coma Joslin believes alkali is needless, whereas it has been Wilder s practice to employ 250 to 500 cc of a solution of 5 percent sodium bicarbonate intravenously if there is a lag in recovery of the carbon dioxide combining power after the blood sugar level falls

Hartmann and his co-workers have shown that sodium lactate may be substituted for sodium bicarbonate to advantage Clinical results have been grati fying The conversion of sodium lactate into sodium bicarbonate, although rapid enough to be effective even in the most severe cases of acidosis, is gradual enough to prevent the development of uncompensated alkalosis, which tends to follow

administration of sodium bicarbonate solution Sodium lactate solution is non-irritating, is stable, and can be sterilized by boiling It can be injected intraperitoneally or subcutaneously as well as intravenously, or it can be given orally in some instances Sodium lactate solution is antiketogenic, the molar solution corresponding to 18 percent dextrose solution It particularly favors glycogen deposition in the liver

Hartmann has emphasized the desirability of supplementing the administration of sodium lactate with mineral salts or electrolytes in treating severe diabetic acidosis He recommends

1 The immediate parenteral administration (one-half intravenously, the remainder subcutaneously and intraperitoneally) of 60 cc of a sixth-molar solution of racemic sodium lactate per kilogram of body weight

2 Immediate administration of 2 units of Insulin per kilogram of body weight

3 Administration of 40 cc of Ringer's Solution per kilogram of body weight as soon after giving the sodium lactate as possible

4 Repeated administration of Insulin six hours later in a dose of one-half unit per kilogram of body weight

5 Transfusion of citrated whole blood or plasma (20 cc per kilogram of body weight) if edema due to reduced plasma protein develops

If preferred, a suitable mixture of sodium lactate and Ringer's Solution may be prepared by adding 10 cc of the molar sodium lactate solution (just as it comes from the ampoule) and 1 6 cc of Lactate-Ringer's Solution (twenty five times concentrated) to 100 cc of sterile, freshly distilled water and giving the patient 100 cc of this mixture per kilogram of body weight (One-half the total dose should be given intravenously, the remainder subcutaneously and intraperitoneally)

Gastric Lavage—Unless the patient is *in extremis*, removal of the gastric contents by lavage should be a routine procedure at the beginning of treatment Two hundred and fifty to 500 cc of warm sodium bicarbonate solution may be left in the stomach A cleansing enema should be given routinely

Circulatory Stimulants—Usually, circulatory failure and shock are due to lack of sufficient volume of circulating fluids Epinephrine, 0 3 to 1 cc , may be given in collapse, or ephedrine in doses of 0 5 to 1 cc (25 to 50 mg) if the blood pressure is falling Blood transfusion or injection of blood plasma is resorted to in occasional cases when circulatory collapse results in a condition simulating some of the features of shock

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If arterial occlusion is of the arteriosclerotic type the gangrene is dry and no collateral circulation has been developed In the moist or diabetic type of gangrene some collaterals have formed but infection is usually present which may rapidly lead to general sepsis The best treatment for gangrene is to avoid it by daily cleanliness and scrupulous protection of the feet from injury however trivial When gangrene occurs it often involves a surgical procedure not infrequently amputation

The introduction of sulfonamides and penicillin has altered materially the course and outcome of infections of the lower extremities since by means of these drugs the spread and actual focus of an infection can be controlled Obviously no chemotherapeutic agent can be expected to restore dead tissue

Classification—The degree of circulatory impairment as well as severity and extent of infection can be determined by ordinary physical examination and these factors become the bas s for the classification of the lesions (Williams and O Kane) that has been adopted by the New York Diabetes Association (Table VI) General indications for procedure are based upon these findings The most important *systemic findings* are (1) age (2) presence of concomitant disease (cerebral sclerosis coronary sclerosis renal lesion metastatic abscess) (3) evidence of vascular impairment (arcus senilis retinopathy radial sclerosis electrocardiographic changes) and (4) evidence of infection (temperature pulse leukocytosis blood culture) The local findings in the foot and leg further aid in classification Gangrene does not accompany the purely infectious type of lesion which is characterized by redness swelling heat fluctuation and discharge Other important observations are (1) pain (claudication night pain throbbing bone lesion) (2) na ls (thickening transverse lamination) (3) skin (elasticity dryness atrophy loss of hair) (4) muscle and fat atrophy (5) lymphatic involvement (6) arterial thickening and pulsation (femoral popliteal dorsalis pedis posterior tibial) (7) surface temperature (8) vein refilling (9) color changes (elevation pallor dependency rubor lividity) (10) capillary circulation (11) cultures (staphylococci streptococci etc) and lastly (12) x ray evidence of calcification and bone necrosis

There are thus three main classes of lesions the purely vascular purely infect ous and a combination of these designated as mixed The latter can be subdivided according to the varying degrees of vascular impairment occurring together with infection e g 3+ vascular m xed (marked arterial impairment with infection) 2+ vascular mixed (moderate arterial impairment with infection) and 1+ vascular mixed (slight arterial impairment with infection) Management and surgical procedures will depend on these observations (see Table VI)

Routine General Measures—In all cases place the patient in the best possible nutritio ial state by controlling the diabetes by means of an adequate balanced

Food—If the blood sugar level is relatively low and acidosis is persistent, dextrose should be given intravenously Usually, orange juice or ginger ale may be taken very early, and enough carbohydrate can thus be administered by mouth

A fluid diet consisting of 6 oz of orange juice every four hours alternating with 6 oz of milk every four hours, so that the patient receives a feeding every two hours, will provide adequate nutrition for the first day or so during the period of emergency The first few days immediately following recovery from coma are critical ones, for the condition may recur Finally, a diet is planned that will meet the special requirements of the patient, avoiding excess fat and protein Readjustment of the dose of Insulin and the diet, just as in a recent case, may then be accomplished according to methods that have already been described

ARTERIOSCLEROSIS

That diabetic persons are peculiarly liable to develop arteriosclerosis is shown by the greatly increased mortality due to this cause, arteriosclerosis has risen threefold as a cause of death, whereas coma has dropped to one-tenth of its former incidence There is an increasing frequency of cardiac and peripheral arterial involvement, leading to the frequent occurrence of coronary artery disease and gangrene Warren has pointed out the importance of preventing premature arteriosclerosis, which appears to be possible by maintaining the blood sugar within normal limits, by controlling infection and acidosis, and by preventing too high a level of blood lipoids "The sclerotic diabetic of today is reaping the harvest sown long before of inadequate treatment or neglect of the diabetic condition"

CARDIOVASCULAR DISEASE

The possibility that improper treatment with *Insulin may result in damage to the* cardiovascular system has been emphasized by some observers Sudden reductions in the blood-sugar level are sometimes not well borne, and the older diabetic may be physiologically habituated to a hyperglycemic level

Although a high blood-sugar level in the chronically sclerotic patient should not be lowered suddenly, Insulin judiciously used, with an adequate supply of available carbohydrate or dextrose intravenously if necessary, may be very helpful and may even result in reduction in anginal pain and improvement in patients having coronary thrombosis Collens, as well as others, has recommended the careful use of Insulin in the coronary disease of elderly diabetics

GANGRENE

Gangrene is a direct result of arteriosclerosis of the blood vessels of the extremities and not infrequently is complicated by the presence of superimposed infection

If arterial occlusion is of the arteriosclerotic type the gangrene is dry and no collateral circulation has been developed In the moist or diabetic type of gangrene some collaterals have formed but infection is usually present which may rapidly lead to general sepsis The best treatment for gangrene is to avoid it by daily cleanliness and scrupulous protection of the feet from injury however trivial When gangrene occurs it often involves a surgical procedure not infrequently amputation

The introduction of sulfonamides and penicillin has altered materially the course and outcome of infections of the lower extremities since by means of these drugs the spread and actual focus of an infection can be controlled Obviously no chemotherapeutic agent can be expected to restore dead tissue

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There are thus three main classes of lesions the purely vascular purely infectious and a combination of these designated as mixed The latter can be subdivided according to the varying degrees of vascular impairment occurring together with infection e g 3+ vascular mixed (marked arterial impairment with infection) 2+ vascular mixed (moderate arterial impairment with infection) and 1+ vascular mixed (slight arterial impairment with infection) Management and surgical procedures will depend on these observations (see Table VI)

Routine General Measures—In all cases place the patient in the best possible nutritional state by controlling the diabetes by means of an adequate balanced

diet fluids and Insulin Safety in surgery will depend on correction of dehydration and provision of adequate glycogen stores John R Williams has emphasized the importance of these simple measures

1 Elevate and maintain diseased limb on level with heart

2 Remove calluses and corns with sharp scalpel and *carefully* dissect away excess *necrotic* tissue

TABLE VI • *Lesions of Lower Extremities*

(Williams and O Kane)

Class	Criteria	Clinical Findings	Lesion	Procedure
Purely vascular	Marked arterial deficiency no infection	Marked P V D *	Superficial	No operation
		Initial lesion gangrene	Localized	Low amputation (below knee)
		No infection	Extensive	Amputation above knee
Mixed 3+ vascular	Marked arterial deficiency	Marked P V D *		Amputation urgent (sulfa drugs penicillin)
	Infection	Initial lesion gangrene Infection superimposed	Spreading	
2+ vascular	Moderate arterial insufficiency	Moderate P V D *		Amputation urgent (sulfa drugs penicillin)
	Infection	Initial lesion infection Gangrene secondary	Spreading	
1+ vascular	Slight arterial insufficiency	Slight P V D *	Superficial	No operation
	Infection	Initial lesion infection	Localized	Incision drainage amputation of toe
		No gangrene	Spreading	Amputation at calf (urgent) (sulfa drugs penicillin)
Purely infectious	No arterial insufficiency	No P V D *	Superficial	No operation
	Infection	Initial lesion infection	Localized	Incision and drainage (penicillin)
		No gangrene	Spreading	Incision and drainage (urgent) (penicillin)

*P V D —Peripheral vascular disease

3 Use sterile, dry dressings if wound is clean If infected, apply a dressing moist with a mild antiseptic Change these dressings *at least* every day

4 *Avoid* heat, light cradles, hot bottles, and diathermy

5 Enforce hygiene, keep skin *clean* between toes Use gentle massage of limb with alcohol avoiding the area of the lesion Apply lanolin ointment or mineral oil daily

A discussion of the management of the diabetes during surgery will be found on page 80 Prophylactic foot treatment should be a routine part of the management of diabetic patients and such care should be under the supervision of the physician

Prophylactic Foot Treatment

Care of Feet

1 Soak feet in basin of warm soapy water for five minutes each day
2 Dry thoroughly with Turkish towel Be careful to dry between toes
3 Massage with alcohol
4 Massage with lanolin especially the soles where calluses appear and the heels Calluses are thus softened and can eventually be rubbed off
5 Do not wear circular garters or sit with knees crossed
6 Wear shoes that fit and cause no localized pressure
7 Avoid strong, irritating antiseptics The physician should be consulted for even minor injuries to the feet

Foot Exercises

1 Sit on edge of bed point toes upward, then downward Repeat movement ten times
2 Make complete circle with foot ten times
3 Raise both legs to angle of 45 degrees As a support place a chair upside down on the bed Maintain this position for three minutes
4 Let legs hang over side of bed for three minutes
5 Place legs flat on bed for three minutes Cover with blanket

These exercises should be repeated six times They should be practiced daily or twice daily if the feet tend to be cold

INFECTIONS

A mild diabetic becomes a severe diabetic when he has an infection The high mortality in cases of carbuncles is well known and usually is due to neglect or delay on the part of the patient in seeking medical advice If an infection is local it should receive prompt medical and surgical attention if general there is danger of acido

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TABLE VI • *Les ons of Lower Extremit es*
(W ll ams and O Kane)

Class	Cr ter a	Cl n cal F nd ngs	Les on	Procedure
Purely vascular	Ma ked arter al defic ency no nfect on	Marked P V D *	Superficial	No opera on
		In t al les on gangrene	Local zed	Low amputat on (below knee)
		No nfect on	Extens ve	Amputat on abo e knee
M xed 3+ vascular	Marked arter al defic ency	Marked P V D *		Amputat on urgent (sulfa drugs pen c ll n)
		In t al les on gangrene	Spread ng	
	Infect on	Infect on super mposed		
2+ vascular	Moderate a ter al nsuffic ency	Moderate P V D *		Amputat on u gent (sulfa drugs pen c ll n)
		In t al les on nfect on	Spread ng	
	Infect on	Gangrene secondary		
1+ vascular	Sl ght arter al nsuffic ency	Sl ght P V D *	Superfic al	No operat on
	Infect on	In al les on nfect on	Local zed	Incis on dra nage ampu at on of toe
		No gangrene	Spreading	Amputa on at calf (urgent) (sulfa d ugs pen c ll n)
Purely nfect ous	No arter al nsuffic ency	No P V D *	Superfic al	No operat on
	Infect on	In t al les on nfect on	Local zed	Inc s on and dra nage (pen c ll n)
		No gangrene	Spread ng	Inc s on and dra nage (urgent) (pen cillin)

*P V D —Peripheral vascular d sease

3 Use sterile, dry dressings if wound is clean If infected, apply a dressing moist with a mild antiseptic Change these dressings *at least* every day

4 *Avoid* heat, light cradles, hot bottles, and diathermy

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INFECTIONS

sis and coma In any event, the dose of Insulin will need to be increased The bacteria responsible for carbuncle are usually of the group susceptible to penicillin Ten thousand to 20,000 units may be given intramuscularly every three hours, and in large necrotic areas, solutions ranging from 100 to 5,000 units per cc may be infiltrated directly with even better results (Peck) No deleterious effect of penicillin on carbohydrate tolerance has been observed

Between 100 and 200 Gm of carbohydrate daily should be provided in the diet, which may be liquid or semisolid if desirable

INSULIN IN INFECTIONS

The rapidly acting type of Insulin is preferable to the long acting Insulins in the management of patients during an infection, for the dose may require alteration at intervals of only a few hours If the patient is already taking a long-acting Insulin, this should be continued as a basic dose, and fluctuations which occur over and above this requirement should be met with unmodified Insulin

Insulin may be administered every three or four hours as follows, the Benedict test being used to estimate the size of the dose, just as during the treatment of diabetic coma

Red	Orange	Yellow	Green
20 units	15 units	10 units	5 units

In cases previously regulated with a modified Insulin, the unmodified Insulin needed in addition can be calculated as follows

Red	Orange	Yellow	Green
10 units	8 units	6 units	4 units

every 4 to 6 hours

Diabetics also suffer from tuberculosis, the most susceptible are those having diabetes of long duration, those just recovered from coma, and those poorly controlled *Prevention is of paramount importance*, and a periodic re examination, including routine x ray studies of the chest, is most desirable Treatment involves control of the diabetes with diet and Insulin, institutional care, and surgical management of the tuberculosis by the most advanced methods

SURGERY IN THE DIABETIC

Diabetic patients may be affected by any of the diseases for which operations are commonly performed, and in addition they are especially liable to certain conditions such as cholecystitis, carbuncles, and gangrene of the extremities Because of associated obesity, arteriosclerosis, and the advanced age of many of the patients, surgery in the diabetic naturally carries with it an increased risk Nevertheless,

since the advent of Insulin, the average surgical mortality rate for diabetic patients has decreased markedly, not only as a result of the use of Insulin but also from clearer understanding and improved technic in the management of the special problems involved The proper care of a diabetic patient who needs an operation demands the combined services of the internist and the surgeon both of whom are interested in the disease Best results are obtained in cases where there is the best teamwork

PREOPERATIVE PREPARATION

The measures employed must be varied according to the urgency of the situation Ideally, the primary disease diabetes, should be under control so that the patient is able to take a nutritionally adequate diet without acidosis hyperglycemia or glycosuria The protective value of a store of glycogen in the liver can scarcely be overestimated even in the nondiabetic coming to operation

The importance of adequate total nutrition is being stressed more and more and since the surgical patient is already ill it is even more likely that he will have low vitamin reserves The discussion that is given under Vitamins (see page 74) applies to the treatment of the postoperative case as well as to the management of the case in coma In addition the influence of vitamin C on wound healing must be given special attention During the preoperative and postoperative periods an intake of 200 to 500 mg of ascorbic acid daily should be assured either by dietary means or through the administration of the pure substance

Elective Cases—If there is no need for haste and the diabetes is already under control no deviation from standard treatment is necessary except that the food should be given in easily assimilable form and the patient fed to within three hours of operation *The usual carbohydrate allowance should not be restricted* but the carbohydrate, as well as all the food, should be given in the simplest soluble form On the day before operation liquids should be supplied freely by mouth or rectum If the patient has been taking Insulin, his usual total daily dose may be given on the day of operation in smaller individual doses at more frequent intervals and irrespective of meals Frequent urine examinations afford helpful information in determining Insulin dosage Essentially all diabetics undergoing surgery require some Insulin

Some authorities believe that modified Insulins have simplified the management of the surgical diabetic patient The basic dose of these Insulins may be continued through the emergency period, and small supplementary doses of unmodified Insulin may be given at intervals of four to six hours after operation should urine tests show red or yellow with Benedict s solution (see page 80) The breakfast on the morning of operation can be replaced by intravenous dextrose infusions

and these can be continued when necessary to tide the patient over until he can take food by mouth

The "glucose equivalent" is utilized when intravenous dextrose is substituted for the diet This may be calculated in the following manner

Carbohydrate is considered as 100 percent available, protein, as 58 percent, and fat, 10 percent For example, a diabetic has been receiving a daily diet of 150 Gm carbohydrate, 75 Gm protein, and 65 Gm fat

$$\begin{aligned} 100\% \text{ of } 150 &= 150 \\ 58\% \text{ of } 75 &= 43\ 5 \\ 10\% \text{ of } 65 &= \underline{\ \ 6\ 5} \\ \text{Glucose equivalent} &= 200\ 0 \text{ Gm glucose} \end{aligned}$$

Extreme accuracy is not essential One third of 200 Gm (equal to one meal) is given morning, noon, and evening, representing the three meals Insulin dosage frequently remains unchanged in the well balanced, stable case, and the usual single injection of Insulin mixture or of NPH Insulin is given in the morning before surgery and may be adequate in such cases Patients can be maintained for two or three days in this manner or until they are able to tolerate food by mouth Liquid and soft diets which may follow the feedings of intravenous glucose are, of course, calculated on the basis of the original diet prescription If preferred, the "six-hour plan" may be utilized by administration of 50 Gm of dextrose every six hours, accompanied by a suitable dose of unmodified Insulin

Variations in glycosuria and blood sugar level indicate how the supplementary Insulin is to be distributed for the day A single blood-sugar estimation is not sufficient, because fluctuations which occur during periods of several hours may make a single examination very misleading If the patient's urine is sugar-free or contains less than 10 Gm of sugar and if the blood sugar level is below 200 mg , the operation can be successfully performed as far as diabetic control is concerned, provided that control is maintained When dealing with infections, it is better treatment to rid the patient of his infection than to make a rigorous attempt to get him sugar-free, either before or after operation The important thing is to free him of acidosis as rapidly as possible

Emergency Cases—Advanced acidosis with incipient coma should be brought under control, partially at least, before major surgery under general anesthesia is undertaken The administration of salt solution and dextrose by hypodermoclysis or by vein and of sufficient Insulin to keep the blood sugar level controlled usually results in sufficient improvement so that undue delay in performing a necessary surgical operation can be avoided Especially in the presence of an infection, urgent surgery should not be long delayed Glycosuria does not contra

indicate operation For administration during the few hours which precede operation, oatmeal gruel, orange juice, and other liquid carbohydrates are recommended If carbohydrate cannot be taken by mouth, it can be given intravenously or rectally Insulin dosage can be determined only by the condition of the patient and the laboratory examinations Frequent small doses (10 to 20 units every two three, or four hours), irrespective of meals, are preferable to large doses given at longer intervals With the correction of a surgical condition especially an infectious process, carbohydrate tolerance improves and reduction in Insulin dosage is likely to be necessary

THE ANESTHETIC

Insulin permits use of practically any type of anesthesia that is necessary, but McKittrick and Root more commonly administer ethylene and spinal anesthesia Chloroform should probably never be used

POSTOPERATIVE CARE

It is good routine practice to begin the injection of dextrose before the patient leaves the operating room If indicated by his condition, 500 or 1,000 cc of 5 or 10 percent dextrose may be administered intravenously The level of the blood sugar should be determined at two-hour intervals for six or eight hours then three times daily for the next two days If this is impossible, frequent urine examinations will have to serve Acidosis is much more serious than sugar in the urine Transient glycosuria after operation is a regular occurrence Nevertheless, liquid carbohydrate feedings should be instituted three hours after operation Thin milk, orange juice, ginger ale and oatmeal water gruel may be allowed freely during the first twenty four hours During each twenty four hours, at least 100 Gm of carbohydrate should be provided and if oral feedings are impossible, ingestion can be assured by intravenous administration of dextrose The diet may soon be increased to meet the body requirements of the patient, enough Insulin being given to insure utilization

DIABETES DURING PREGNANCY

Diabetes having its onset during pregnancy may be difficult to recognize, because other factors may be responsible for loss of sugar tolerance Glycosuria occurs so commonly in pregnancy that some observers have stated that if enough specimens are examined in a given case, one will always be found that is positive The renal threshold may actually be lowered in many patients, because the sugar excreted is usually dextrose Blood sugar estimations are therefore essential not only for diagnosis, but for guidance in estimating the dose of Insulin for the

known diabetic patient The same criteria for diagnosis in the nonpregnant hold for the diagnosis of diabetes during pregnancy

Abortions occur three times as frequently in diabetic mothers as in the normal, and stillbirths are from three to six times as common White's present view is that an abnormal rise of serum chorionic gonadotrophin after the twentieth week predicts accidents, which are brought on by failure of production or metabolism of estrogen and progesterone In contrast to the high mortality in a group of patients whose values for serum chorionic gonadotrophin were higher than normal, and who received no therapy, was the low mortality of those receiving substitutional estrogen and progesterone therapy Dosage of diethylstilbestrol ranged from 40 to 120 mg orally, or from 10 to 30 mg intramuscularly plus 10 to 20 mg of progesterone Premature deliveries did not occur, and fetal survival increased from 42 percent in the untreated group to 93 percent

Results reported by the Smiths suggest that diethylstilbestrol alone may be adequate In preventing accidents of pregnancy which are likely to occur before the fifth month, they advise oral administration of diethylstilbestrol according to the following schedule

Week of Pregnancy Dating from First Day of Last Menstrual Period	Daily Dose	Week of Pregnancy Dating from First Day of Last Menstrual Period	Daily Dose
7th and 8th	5 mg	24th	70 mg
9th and 10th	10 mg	25th	75 mg
11th and 12th	15 mg	26th	80 mg
13th and 14th	20 mg	27th	85 mg
15th	25 mg	28th	90 mg
16th	30 mg	29th	95 mg
17th	35 mg	30th	100 mg
18th	40 mg	31st	105 mg
19th	45 mg	32d	110 mg
20th	50 mg	33d	115 mg
21st	55 mg	34th	120 mg
22d	60 mg	35th	125 mg
23d	65 mg		

TREATMENT

The chief complications that are to be guarded against are coma and hypoglycemia Diabetic control during actual labor and the readjustments required during the puerperium also necessitate close supervision

In general, the treatment of diabetes during pregnancy does not differ from that of the nonpregnant diabetic Sufficient caloric intake should be provided to balance the rise in metabolism that occurs (probably 20 percent at term) and to provide for the baby's need for glycogen The lowering in the renal threshold

which sometimes occurs makes blood sugar estimations essential and may make it impossible to render the urine sugar free without production of hypoglycemia Different opinions have been expressed in regard to the effect of pregnancy upon diabetes In one large series individual patients showed gains, losses or a stationary status One third took less Insulin in the third than in the first trimester, one half took less in the second trimester than in the first and one half the patients required less Insulin in the third than in the second trimester Two thirds of the patients took less Insulin during the postpartum period than they required during the third trimester

First Trimester—Early nausea and vomiting can best be treated by hourly feedings and the administration of Insulin every three to four hours according to the color of the Benedict test (page 80)

Second Trimester—There is but little special care required in the second trimester other than the usual attention to the diet and readjustments in Insulin dosage if they appear to be indicated The lowering of the renal threshold which occurs not infrequently during this period may lead to the appearance of glycosuria without a corresponding elevation of the blood-sugar level Consequently more dependence should be placed on estimations of the blood sugar level than on the amount of sugar in the urine as a guide to changes in the dosage of Insulin

Third Trimester—More frequent observations are indicated and the obstetrician should determine as far as possible the size of the baby if it is unduly large a choice must be made between early induction of labor and cesarean section An increase in diet will be necessary in most instances for the baby alone will require about 50 Gm of dextrose daily and in addition the basal metabolism has increased to its highest level During normal labor about 10 Gm of carbohydrate per hour (150 to 300 Gm total) should be made available If delivery is by operative means the same preparations and aftercare are applicable as those employed during other surgical procedures (pages 80 83)

CHOICE OF DELIVERY

A prolonged and difficult labor either normal or induced exposes the diabetic to several hazards including glycogen depletion danger of sepsis, and danger of hypoglycemia and acidosis likewise there is danger to the baby, which is apt to be large flabby and overdeveloped As a result some clinicians advise the delivery of the diabetic primipara by cesarean section Should this appear necessary the usual precautions and methods of preparation outlined under the section on Surgery in the Diabetic are applicable

Lactation is usually unsatisfactory and represents an additional strain for the diabetic mother Most of these patients are unable to nurse their babies

HYPOGLYCEMIA IN THE NEWBORN

Since the description by Rynearson and Randall of the occurrence of spontaneous hypoglycemia in newborn babies of diabetic mothers, other reports have appeared and the frequency of the condition has been pointed out It should be kept in mind that the newborn normally have a low blood-sugar level Convulsive seizures, unusual pallor, or other abnormalities in these infants should be suspected as symptoms of hypoglycemia A blood-sugar estimation should be made immediately, if the level is unduly low, feedings by tube or infusions of dextrose at intervals during the first few days of readjustment to extrauterine life usually serve to correct the condition, which will not ordinarily be misdiagnosed if one is on guard

SECTION 5

Insulin, Lilly, Preparations

and Accessories of Interest to the Physician Treating Diabetes

INSULIN, LILLY

In May, 1922, following the discovery of Insulin, the Insulin Committee of the University of Toronto accorded to the Lilly Research Laboratories the privilege of co operating with the original investigators in the development of a process for the large scale manufacture of a highly purified, stable, uniform preparation of Insulin

Years of research and experience in the manufacture of large lots of Insulin, Lilly, have resulted in the development of methods of preparation and standardization that insure purity, stability, and constant unitage of the product within quite narrow biological limits Purity, stability, and uniformity are essential to satisfactory results

The dependable unitage of Insulin, Lilly, affords the patient protection against disturbances which might follow a change from one lot to another if the lots in question were not of uniform potency

Ever since the development of the first methods of large-scale production of Insulin, Lilly, both beef and pork pancreas have been the source of supply, and the product regularly available since 1922 has been derived from both

INSULIN, LILLY, MADE FROM ZINC-INSULIN CRYSTALS

Early efforts to purify the relatively crude Insulin of the period immediately following its discovery led to the crystallization of Insulin in 1926 by Abel and his associates, of Johns Hopkins The commercial production of crystalline prepara-

tions of Insulin was not practical, however, until Scott, of the University of Toronto, discovered and elucidated the relationship of the metals zinc, cobalt, cadmium, and nickel to the crystallization of the hormone A substantial quantity of zinc-Insulin crystals was then prepared at Toronto and adopted by the League of Nations in 1935 as the Insulin standard for the world Since then, this original crystalline material has served as the basis for comparison in the standardization of all Insulin manufactured

As now commercially prepared, under specifications established by the Insulin Committee, University of Toronto, and by methods based on the original work of Scott, Insulin, Lilly, made from zinc-Insulin crystals represents a solution of essentially chemically pure zinc-Insulin crystals Such crystals, prepared from the active antidiabetic principle of the pancreas, together with a small quantity of zinc (*this element having been combined with the active principle in the formation of the crystals*), are typical of the only forms in which the active antidiabetic principle has been prepared in a chemically pure, crystalline state Its advantages over Insulin prepared from amorphous material are those inherent in a product of high chemical purity Local reactions and general allergic phenomena, such as urticaria, are in many instances avoided or reduced in severity, and certain evidence indicates that it may sometimes permit a slightly greater utilization of sugar than does Insulin of noncrystalline origin

Insulin, Lilly, made from zinc Insulin crystals is a rapidly acting Insulin and should not be confused with Protamine Zinc Insulin, which has a slow but prolonged (twenty-four to forty-eight hours) action In the main, its physiological effect is essentially identical with that of Insulin of noncrystalline origin, as are the rapidity of its onset and the duration of its blood-sugar-lowering action

PROTAMINE ZINC INSULIN, LILLY

The development of Protamine Insulin preparations in 1935 by Dr H C Hagedorn and his associates, of Copenhagen, Denmark, and subsequent modification in co-operation with the Toronto investigators mark another great advance in the treatment of diabetes A means for prolonging the transient action of Insulin had long been sought and was finally achieved by preparation of the antidiabetic hormone in sparingly soluble form as Protamine Zinc Insulin The clinical application of this product in many thousands of cases of diabetes shows clearly that principles of diabetic management, so firmly established during the past years, need not be altered although certain details must be modified with a view to taking full advantage of the more deliberate yet powerful action of this product as compared with that of unmodified Insulin

Protamine Zinc Insulin, by reducing the number of injections required

daily and by correcting the nocturnal hyperglycemia common in the severe case, has brought the diabetic another step closer to normal living Protamine Zinc Insulin, Lilly, is prepared from Insulin, Lilly, by means of the same time-tried methods of control and standardization which have always assured purity, stability, and uniform potency of the product

NPH INSULIN, LILLY

NPH Insulin, Lilly, is an improved and distinctive Insulin modification consisting of a suspension of crystals of Insulin, protamine, and zinc Intermediate in action it provides a blood-sugar-lowering effect lasting slightly over twenty-four hours in most cases It was deliberately selected because of its unique time-effect, which closely resembles the action of 2 1 mixtures of Insulin and Protamine Zinc Insulin

It is axiomatic that any new discovery solves one set of problems but immediately precipitates others Because of the rapid but evanescent action of Insulin, it was found necessary to administer it in relation to the metabolic load of the patient, so that in severe cases injections were required before each meal A major problem that developed during the years between 1922 and 1936 was how to control the blood sugar level in the fasting condition, a contingency which aroused considerable apprehension about ultimate effects on the development of complications

The problem of nocturnal control was finally solved by Hagedorn's discovery that the action of Insulin could be modified and extended by combining this substance with certain protein precipitants, namely, the protamines, histones, kyrin, and globin Protamine was finally chosen as the precipitant most likely to be useful clinically, and after the role of zinc had been more fully elucidated by the Toronto group, its incorporation into the combination resulted in the ultimate marketing of Protamine Zinc Insulin as now available The great contribution of Protamine Zinc Insulin to the management of diabetes lies in its peculiar attribute of controlling the nocturnal blood-sugar level

Protamine Zinc Insulin, too, projected new problems With it, individual readjustment of the patient's habits of eating, alterations in the percentage distribution of the dietary, and abnormal spacing of meals and between meal feedings have been resorted to in attempts to adjust the individual s metabolic load to the time-activity of Protamine Zinc Insulin In spite of this, there has remained a group of severe cases requiring multiple doses of Insulin and Protamine Zinc Insulin before both daytime and nighttime control can be successfully established Studies have therefore been made of Insulin modifications having varied rates of onset and durations of action This signifies another new step in the progress of therapy Rather than to readjust the patient s conditions to fit the action of the

Insulin, an attempt has been made to prepare Insulin modifications which fit the *average needs of the patient NPH Insulin is the culmination of a long series of* studies of intermediate acting preparations Although it is a distinct chemical entity, it duplicates in large measure the more ideal timing effected by the so-called 2 1 mixture of Insulin and Protamine Zinc Insulin NPH Insulin is unique in that it provides a highly desirable blending of these effects in a single product which is highly purified, *constant, and crystalline in form*

NPH Insulin was chosen from a large group of modifications as the preparation most nearly suited to the needs of the majority of diabetic patients In most cases it can be expected to act with sufficient intensity and rapidity to maintain desirable levels of daytime control without sacrificing the control of the nocturnal blood-sugar level

MEASUREMENT OF INSULIN, PROTAMINE ZINC INSULIN, AND NPH INSULIN

Insulin, Protamine Zinc Insulin, and NPH Insulin are measured in units and are supplied in various concentrations The strength of the various preparations (that is, the number of units contained in each cubic centimeter) is plainly designated on the vial of Insulin, Lilly, as U-20, U-40, U-80, or U-100, on the vial of Insulin, Lilly, made from zinc-Insulin crystals and on that of NPH Insulin, Lilly, as U 40 or U-80, or, in the case of Protamine Zinc Insulin, Lilly, simply as 40 or 80 units per cc A standard color of rubber stopper has been maintained for each concentration of Insulin, Lilly, preparations yellow for 20 units per cc , red for 40 units per cc , green for 80 units per cc , and orange for 100 units per cc Thus

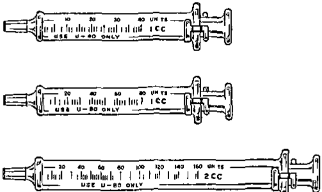
1 cc of U 20 Insulin contains 20 units
1 cc of U 40 Insulin contains 40 units
1 cc of U 80 Insulin contains 80 units
1 cc of U 100 Insulin contains 100 units

Therefore, if a patient requires a 10-unit dose of Insulin, he can obtain it in the following ways by injecting 1/2 cc of the U-20 concentration, 1/4 cc of the U-40 concentration, 1/8 cc of the U-80 concentration, or 1/10 cc of the U-100 concentration

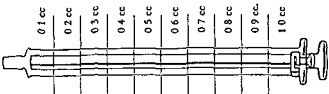
The total volume of each such dose varies with each concentration, but the actual effect in terms of carbohydrate combustion remains the same since the same number of Insulin units is represented It is recommended that for each case a concentration be selected that will allow each dose to be administered in a volume not exceeding 0 5 cc The U-40 concentration is most commonly used

The site of injection of succeeding doses should be varied Literature describing the technic of administration accompanies each package

HOW TO MEASURE INSULIN



The above diagrams show the marking style approved by the American Diabetes Association and are known as the Official Insulin Syringes. Only one scale is used; markings are in *red* for U-40 and in *green* for U-80 concentrations (40 and 80 units per cc respectively).



40 units per cc	4	8	12	16	20	24	28	32	36	40 units
80 units per cc	8	16	24	32	40	48	56	64	72	80 units
100 units per cc	10	20	30	40	50	60	70	80	90	100 units

The above diagram shows how to measure a given dose of Insulin preparations with syringes calibrated in tenths of 1 cc.

HOW SUPPLIED

Insulin, Lilly, is supplied in 10-cc. vials, designated U-20, U-40, U-80, and U-100 and containing 20, 40, 80, and 100 units per cc. respectively. The U-20 and U-40 concentrations are also supplied in 5-cc. vials.

Insulin, Lilly, made from zinc-Insulin crystals is supplied in 10-cc. vials, designated U-40 and U-80 and containing 40 and 80 units per cc. respectively.

Protamine Zinc Insulin, Lilly, is supplied in 10-cc. vials containing 400 and 800 units and labeled 40 and 80 units per cc. respectively.

NPH Insulin, Lilly, is supplied in 10-cc "rounded square" vials, designated U-40 and U-80 and containing 40 and 80 units per cc respectively

Store in a cold place, preferably a refrigerator

ACCESSORIES OF INTEREST TO THE PHYSICIAN TREATING DIABETES

Ampoules Dextrose (*d*-Glucose) Solution, Lilly—These ampoules are especially designed for intravenous use in emergencies

Intravenous injections of dextrose are indicated in conjunction with Insulin in certain cases of diabetic coma and in combating the late stages of hypoglycemia

Lilly dextrose ampoules are made from an exceptionally pure dextrose (U S P) and supplied as approximately 50 percent solutions Further dilution to the desired concentration should be made with *sterile distilled water*

AMPOULES DEXTROSE (*d*-GLUCOSE) SOLUTION, 10 Gm , 20 cc , contain a sterilized solution of Dextrose, U S P , 10 Gm , in Water for Injection, U S P , q s to make 20 cc Supplied in packages of 100 ampoules (No 200)

Vitamin Preparations—The following selected Lilly vitamin preparations are particularly applicable to therapy in diabetes

BETALIN S (Thiamin Chloride, Lilly), in various dosage forms for both oral and parenteral administration

'BECOTIN' (Vitamin B Complex, Lilly) (No 300) Supplied in packages of 30, 100, and 1,000 pulvules

'BECOTIN WITH VITAMIN C' (Vitamin B Complex with Vitamin C, Lilly) (No 325) Supplied in packages of 30, 100, and 1,000 pulvules

'CEVALIN' (Ascorbic Acid, Lilly), in packages of 6 and 100 ampoules containing 100 mg in 2 cc (No 319), in packages of 2, 6, 25, and 100 ampoules containing 500 mg in 1 cc (No 424), in packages of 6, 25, and 100 ampoules containing 500 mg in 5 cc (No 373), and in packages of 6, 25, and 100 ampoules containing 1 Gm in 10 cc (No 374)

NICOTINAMIDE (Nicotinic Acid Amide), in packages of 6 and 100 ampoules containing 100 mg in 2 cc (No 345)

NICOTINIC ACID, in packages of 6 and 100 ampoules containing 100 mg in 10 cc (No 327)

RIBOFLAVIN, in tablets, and in ampoules with nicotinamide

'MULTICEBRIN' (Pan-Vitamins, Lilly), in packages of 30, 100, and 1,000 gelseals (No 100), designed to furnish in one dose the average daily vitamin requirement

THERACEBRIN (Pan Vitamins Therapeutic Lilly) in packages of 30 and 100 gelseals (No 200) for treatment of multiple vitamin deficiencies

Ampoules Lactate Ringer's Solution (twenty five times concentrated) 10 cc in packages of 6 and 100 ampoules (No 261) 20 cc in packages of 100 ampoules (No 262) The concentrated solution diluted twenty five times makes the lactate Ringer s solution for clinical use

Tablets Saccharin, Soluble—Tablets Saccharin Soluble are available in small glass flasks Saccharin is approximately five hundred times sweeter than cane sugar and may be used safely by the diabetic Only a very small amount of saccharin is needed When an excessive amount is used it causes a bitter taste In susceptible persons saccharin may produce gastro intestinal disturbances headache and nervous irritability

Urine Sugar Test Case, Sheftel, is a compact portable set suitable for the hand bag it employs reagents in tablet form so that there is no danger of spilling It can be set up anywhere and an accurate quantitative test for sugar can be run in five minutes (see page 152)

Wilkerson Heftmann Blood-Sugar Screening Test Kit—A portable kit for a rapid and simple test to determine blood sugar within certain ranges using finger tip (capillary) blood (see page 152)

SECTION 6

The Diet Prescription

THE FOOD requirements of the diabetic patient depend upon various factors, such as age, weight, height, sex, exercise, and general condition Therefore, the appropriate diet prescription, i e , the total calories and the proportion of carbohydrates, protein, and fat, should be determined by the physician for each patient individually, and it may be necessary from time to time to change the prescription according to changes in the patient's condition, such as gain or loss in weight, illness, infection, and the like

The following sample menus have been selected as representative of diets in general use in the United States The amount of each food is given both in grams and in household measures Weighing food is a more accurate method of determining its amount than measuring it with household utensils such as teaspoons, tablespoons, and cups, however, household measures will prove useful under circumstances in which weighing is impossible Liquids may be measured by volume with accuracy

The menus have been arranged according to the several methods and ratios in common use today and are based on the newer classification of foods by the U S Department of Agriculture Class I Menus (Menus 513, 561, 605, and 653) are companions respectively to Menus 510, 554, 602, and 650 They are included for those who still prefer diets of the high fat, low-carbohydrate type

Class II of these menus (Menus 510, 554, 602, and 650) consists of diets having a ratio of carbohydrate to fat of approximately 1½ to 1 Menu 510 is suitable for starting treatment in the adult Menus 554, 602, 650, and 607 are theoretically appropriate for adults weighing 50, 60, 70, and 80 kilograms* respectively They provide the usual 30 calories per kilogram of body weight and have been prepared in accordance with the present tendency to replace fat with carbohydrates

Class III (Menus 579, 583, 587, 591, 595, 599, and 607) consists of menus arranged according to a higher ratio of carbohydrate to fat, namely, 2 to 1 These

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Note To change grams to ounces divide the number of grams by 30
*1 kilogram = 2 2 pounds

Class I Diets • Menu No. 561

Ratio Gm C to Gm F		1 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat →		Carbohydrate 110 Gm; Protein 50 Gm; Fat 110 Gm } 1,630 Calories			

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit, Group IV*	100	1 med orange	12	1	0
Cereal*	15	¾ c corn flakes	11	2	0
Egg	50	1 av	0	6	6
Bacon, crisp	10	2 thin strips—3½" long	0	2	5
Bread	15	½ av slice	7	1	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter, or fat	20	4 t	0	0	16
Total for Meal			36	16	37
Noon					
American cheese*	30	1⅓ slices—3½"x2½"x⅛"	0	7	10
Vegetable, Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group III*	100	½ c young peas	9	3	0
Bread	15	½ av slice	7	1	0
Fruit, Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter, or fat	20	4 t	0	0	16
Total for Meal			37	18	36
Evening					
Meat, lean, cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable, Group I*	100	¾ c green beans, cn	3	2	0
Vegetable, Group III*	100	¾ c diced carrots	9	3	0
Bread	20	⅔ av slice	10	2	0
Fruit, Group IV*	100	2½ slices pineapple—¼" tk, 3" d	12	1	0
Milk					
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter, or fat	30	2 T	0	0	24
Total for Meal			36	18	36
TOTAL FOR DAY			109	52	109

ABBREVIATIONS Gm—Gram. C—Carbohydrate P—Protein F—Fat. T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns.—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See "Equivalents and Substitutes"

Class I Diets • Menu No 605

Ratio Gm C to Gm F	1 to 1	
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat →	Carbohydrate 120 Gm Protein 60 Gm Fat 120 Gm	1 800 Calories

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit Group IV*	100	1 med orange	12	1	0
Cereal*	15	¾ c corn flakes	11	2	0
Egg	50	1 av	0	6	6
Bacon crisp	15	3 thin strips—3½" long	0	4	8
Bread	20	⅔ av slice	10	2	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter or fat	15	1 T	0	0	12
Total for Meal			**40**	**19**	**40**
Noon					
American cheese*	30	1½ slices—3¼"x2½"x⅛"	0	7	10
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	15	½ av slice	7	1	0
Fruit Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	150	¾ glass or 5 oz	7	5	6
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter or fat	17	3½ t	0	0	14
Total for Meal			**40**	**20**	**40**
Evening					
Meat lean cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable Group I*	100	¾ c green beans cn	3	2	0
Vegetable Group III*	100	¾ c diced carrots	9	3	0
Bread					
Fruit Group IV*	150	3¾ slices pineapple—¼" tk 3" d	18	1	0
Milk	150	¾ glass or 5 oz	7	5	6
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter or fat	27	5½ t	0	0	22
Total for Meal			**39**	**21**	**40**
TOTAL FOR DAY			**119**	**60**	**120**

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns.—unsweetened gl—glass tom—tomato jc—juice veg—vegetable
*See *Equivalents and Substitutes*

Class I Diets • Menu No 653

Ratio Gm C to Gm F	1 to 1
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat	Carbohydrate 140 Gm.; Protein 70 Gm; Fat 140 Gm — 2,100 Calories

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit, Group IV*	100	1 med orange	12	1	0
Cereal*	20	½ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	100	2 av	0	13	11
Bacon					
Bread	25	⅝ av slice	12	2	1
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	60	4 T or 2 oz	2	2	12
Butter, or fat	25	5 t	0	0	20
Total for Meal			46	23	48
Noon					
American cheese*	20	1 slice—3¼"x2¼"x⅛"	0	5	6
Vegetable, Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group III*	100	½ c young peas	9	3	0
Bread	20	⅔ av slice	10	2	0
Fruit, Group IV*	100	2 med. peach halves—2½" d	12	1	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	60	4 T or 2 oz	2	2	12
Butter, or fat	25	5 t	0	0	20
Total for Meal			46	22	46
Evening					
Meat, lean cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable, Group I*	100	¾ c green beans, cn	3	2	0
Vegetable, Group III*	100	¾ c diced carrots	9	3	0
Bread	30	1 av slice	15	3	1
Fruit, Group IV*	100	2½ slices pineapple—¼" tk, 3" d	12	1	0
Milk	150	¾ glass or 5 oz	7	5	6
Cream—Coffee	60	4 T or 2 oz	2	2	12
Butter, or fat	31	2 full T	0	0	25
Total for Meal			48	25	46
TOTAL FOR DAY			140	70	140

ABBREVIATIONS Gm —Gram C—Carbohydrate P—Protein F—Fat T —Tablespoon t—teaspoon. oz —ounces c —cup cn —canned ck —cooked d —diameter av —average med —medium tk —thick uns —unsweetened gl —glass tom —tomato jc —juice veg —vegetable
*See Equivalents and Substitutes

Class II Diets • *Menu No 510*

Ratio Gm C to Gm F		1½ to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat		Carbohydrate 105 Gm; Protein 40 Gm; Fat 70 Gm — 1,210 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit Group IV*	100	1 med orange	12	1	0
Cereal*	15	¾ c corn flakes	11	2	0
Egg					
Bacon crisp	15	3 thin strips—3¼" long	0	4	8
Bread	15	½ av slice	7	1	0
Milk	120	1 4-oz glass	6	4	5
Cream—Coffee					
Butter or fat	11	2 full t	0	0	9
Total for Meal			36	12	22
Noon					
American cheese*	20	1 slice—3¼"x2½"x⅛	0	5	6
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	20	⅔ av slice	10	2	0
Fruit Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk skim					
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	15	1 T	0	0	12
Total for Meal			35	14	24
Evening					
Meat lean cooked					
Vegetable Group I*	100	¾ c green beans cn	3	2	0
Vegetable Group III*	100	¾ c diced carrots	9	3	0
Bread					
Fruit Group IV*	100	2½ slices pineapple cn—¼" tk 3" d	12	1	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	12	2½ t	0	0	10
Total for Meal			35	14	24
TOTAL FOR DAY			106	40	70

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See Equivalents and Substitutes

Class II Diets • Menu No 554

Ratio Gm C to Gm F		1½ to 1		
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat	Carbohydrate	135 Gm	1 550 Calories	
	Protein	50 Gm		
	Fat	90 Gm		

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit Group IV*	100	1 med orange	12	1	0
Cereal*	15	¾ c corn flakes	11	2	0
Egg	50	1 av	0	6	6
Bacon					
Bread	30	1 av slice	15	3	1
Milk	120	1 4-oz glass	6	4	5
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	16	1 full T	0	0	13
Total for Meal			45	17	31
Noon					
American cheese*	30	1½ slices—3¼"x2½"x⅛"	0	7	10
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	30	1 av slice	15	3	1
Fruit Group IV*	150	3 med peach halves—2½" d	18	1	0
Milk					
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	15	1 T	0	0	12
Total for Meal			46	17	29
Evening					
Meat lean cooked					
Vegetable Group I*	100	½ c green beans cn	3	2	0
Vegetable Group III*	100	½ c diced carrots	9	3	0
Bread	15	½ av slice	7	1	0
Fruit Group IV*	100	2½ slices pineapple—½" tk 3" d.	12	1	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	60	4 T or 2 oz	2	2	12
Butter or fat	12	2½ t	0	0	10
Total for Meal			43	16	30
TOTAL FOR DAY			134	50	90

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See Equivalents and Substitutes

Class II Diets • Menu No 602

Ratio Gm C to Gm F		1⅓ to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat ⋙→		Carbohydrate 165 Gm, Protein 60 Gm, Fat 110 Gm } 1 890 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit Group IV*	150	¾ glass or 5 oz orange juice	18	1	0
Cereal*	20	⅔ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon crisp	10	2 thin strips—3¼" long	0	2	5
Bread	30	1 av slice	15	3	1
Milk	150	¾ glass or 5 oz	7	5	6
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	15	1 T	0	0	12
Total for Meal			56	20	36
Noon					
American cheese*	30	1⅓ slices—3¼"x2½"x⅛"	0	7	10
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	45	1½ av slices	22	4	1
Fruit Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	120	1 4-oz glass	6	4	5
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	18	3½ t	0	0	15
Total for Meal			53	22	37
Evening					
Meat lean cooked					
Vegetable Group I*	100	¾ c. green beans cn	3	2	0
Vegetable Group III*	100	¾ c diced carrots	9	3	0
Bread	40	1⅓ av slices	20	4	1
Fruit Group IV*	100	2½ slices pineapple—¼" tk. 3" d	12	1	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter or fat	22	4½ t	0	0	18
Total for Meal			56	18	37
TOTAL FOR DAY			165	60	110

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk.—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable
*See "Equivalents and Substitutes"

Class II Diets • Menu No 650

Ratio Gm C to Gm F		1½ to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat →		Carbohydrate 195 Gm, Protein 70 Gm, Fat 130 Gm } 2,230 Calories			

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit Group IV*	200	1 glass or 6⅔ oz orange juice	24	2	0
Cereal*	20	⅔ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	100	2 av	0	13	11
Bacon					
Bread	45	1½ av slices	22	4	1
Milk					
Cream—Coffee	100	½ glass or 3⅓ oz	4	3	20
Butter, or fat	14	1 scant T	0	0	11
Total for Meal			65	24	43
Noon					
American cheese*	20	1 slice—3½"x2½"x¼"	0	5	6
Vegetable, Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group III*	100	½ c young peas	9	3	0
Bread	45	1½ av slices	22	4	1
Fruit Group IV*	200	4 med peach halves—2½" d	24	2	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	60	4 T or 2 oz	2	2	12
Butter or fat	25	1⅔ T	0	0	20
Total for Meal			65	21	43
Evening					
Meat lean cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable Group I*	100	½ c green beans, cn	3	2	0
Vegetable Group III*	100	½ c diced carrots	9	3	0
Bread	45	1½ av slices	22	4	1
Fruit, Group IV*	200	5 slices pineapple—¼" tk , 3" d	24	2	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	60	4 T or 2 oz	2	2	12
Butter, or fat	31	2 full T	0	0	25
Total for Meal			65	25	44
TOTAL FOR DAY			195	70	130

ABBREVIATIONS Gm —Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See Equivalents and Substitutes

Class III Diets • Menu No 579

Rat o Gm. C to Gm F		2 to 1				
DIET PRESCRIPTION Total da ly amount in grams of carbohydrate protein and fat →		Carbohydrate 100 Gm; Prote n 60 Gm; Fat 50 Gm.	1 090 Calories			

Meals	Gm	Household Measures	C	P	F
Morning					
Fru t Group IV*	100	1 med orange	12	1	0
Cereal*	15	¾ c. corn flakes	11	2	0
Egg	100	2 av	0	13	11
Bacon					
Bread	10	⅓ av sl ce	5	1	0
Milk skim	100	½	5	3	0
Cream—Coffee					
Butter or fat	7	2 scai	0	0	7
Total			33	20	18
Noon					
American ch		al ⅓"	0	7	10
Veget			3	2	0
			9	3	0
			12	1	0
			9	6	0
			0	0	6
			[illegible]	19	16
				9	2
				2	0
				3	0
				2	0
				0	0
				5	6
				0	8
				21	16
					50

noon

thick

Class III Diets • *Menu No 583*

Ratio Gm. C to Gm. F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein and fat ⇛		Carbohydrate 120 Gm Protein 60 Gm. Fat 60 Gm. } 1,260 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit Group IV*	100	1 med orange	12	1	0
Cereal*	20	½ scant c. ck oatmeal (2⅔ T dry)	15	2	0
Egg	100	2 av	0	13	11
Bacon					
Bread	15	½ av slice	7	1	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee					
Butter or fat	6	1 full t	0	0	5
Total for Meal			39	20	20
Noon					
American cheese*	30	1¼ slices—3½"x2¼"x⅛"	0	7	10
Vegetable Group I*	200	1 large 3% veg salad, and ½ gl tom. jc	6	4	0
Vegetable Group VI*	100	1 med potato boiled—2½" d	18	3	0
Bread					
Fruit Group IV*	50	1 med peach half—2½" d.	6	0	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee					
Butter or fat	3	½ t	0	0	2
Total for Meal			40	21	20
Evening					
Meat lean cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable Group I*	100	¾ c. green beans cn	3	2	0
Vegetable Group III*	100	¾ c. diced carrots	9	3	0
Bread	30	1 av slice	15	3	1
Fruit Group IV*	100	2½ slices pineapple—¼" tk, 3" d.	12	1	0
Milk					
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter, or fat	14	1 scant T	0	0	11
Total for Meal			40	19	20
TOTAL FOR DAY			119	60	60

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t.—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable
*See Equivalents and Substitutes"

Class III Diets • Menu No 587

Ratio Gm C to Gm F	2 to 1	
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat →	Carbohydrate 140 Gm Protein 60 Gm Fat 70 Gm	1 430 Calories

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit Group IV*	100	1 med orange	12	1	0
Cereal*	10	½ c corn flakes	8	2	0
Egg	50	1 av	0	6	6
Bacon					
Bread	30	1 av slice	15	3	1
Milk skim	200	1 glass or 6⅔ oz	10	7	0
Cream—Coffee					
Butter or fat	20	4 t	0	0	16
Total for Meal			**45**	**19**	**23**
Noon					
American cheese*	30	1⅓ slices—3½"x2½"x⅛"	0	7	10
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable Group VI*	100	1 med potato boiled—2½" d	18	3	0
Bread	10	⅓ av slice	5	1	0
Fruit Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	180	1 scant glass or 6 oz	9	6	7
Cream—Coffee					
Butter or fat	9	2 scant t	0	0	7
Total for Meal			**47**	**20**	**24**
Evening					
Meat lean cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable Group I*	100	¾ c green beans cn	3	2	0
Vegetable Group III*	100	¾ c diced carrots	9	3	0
Bread	35	1 1/6 av slices	17	3	1
Fruit Group IV*	100	2½ slices pineapple—¼" tk 3" d	12	1	1
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	12	2½ t	0	0	10
Total for Meal			**47**	**22**	**24**
TOTAL FOR DAY			**139**	**61**	**71**

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See "Equivalents and Substitutes"

Class III Diets • Menu No. 595

Ratio Gm. C to Gm. F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat →		Carbohydrate 180 Gm Protein 60 Gm Fat 90 Gm } 1,770 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit, Group IV*	150	¾ glass or 5 oz orange juice	18	1	0
Cereal*	20	¾ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon, crisp	15	3 thin strips—3¼" long	0	4	8
Bread	40	1⅓ av slices	20	4	1
Milk	120	1 4-oz glass	6	4	5
Cream—Coffee					
Butter, or fat	12	2⅓ t	0	0	10
Total for Meal			59	21	30
Noon					
American cheese					
Vegetable, Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group VI*	100	1 med potato, boiled—2¼" d	18	3	0
Bread	20	⅔ av slice	10	2	0
Fruit, Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	300	1¼ glasses or 10 oz	15	10	12
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter, or fat	10	2 t	0	0	8
Total for Meal			60	19	30
Evening					
Meat, lean, cooked*	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable, Group I*	100	¾ c. green beans, cn	3	2	0
Vegetable, Group VI*	100	⅓ c corn, cn	18	3	0
Bread	45	1½ av slices	22	4	1
Fruit, Group V*	100	1 med apple—2½" d	15	1	0
Milk					
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter, or fat	21	4 full t	0	0	17
Total for Meal			60	20	30
TOTAL FOR DAY			179	60	90

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable
*See "Equivalents and Substitutes"

Class III Diets • Menu No. 599

Ratio Gm C to Gm F	2 to 1
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein, and fat →	Carbohydrate 200 Gm, Protein 60 Gm, Fat 100 Gm — 1,940 Calories

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit Group IV*	200	1 glass or 6⅔ oz orange juice	24	2	0
Cereal*	25	⅝ c ck oatmeal (3⅓ T dry)	19	3	0
Egg					
Bacon crisp	15	3 thin strips—3¼" long	0	4	8
Bread	25	⅘ av slice	12	2	1
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	*50*	*3⅓ T or 1⅔ oz*	2	1	10
Butter, or fat	10	2 t	0	0	8
Total for Meal			67	19	35
Noon					
American cheese*	20	1 slice—3¼"x2¼"x⅛"	0	5	6
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group VI*	100	1 med potato, boiled—2½" d	18	3	0
Bread	30	1 av slice	15	3	1
Fruit Group IV*	200	4 med peach halves—2½" d	24	2	0
Milk	120	1 4-oz glass	6	4	5
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter, or fat	19	4 scant t	0	0	15
Total for Meal			67	20	33
Evening					
Meat, lean, *cooked**	30	1 slice lean beef—3½"x2½"x¼"	0	9	2
Vegetable, Group I*	100	¾ c green beans, cn	3	2	0
Vegetable Group VI*	150	¾ c corn, cn	27	4	0
Bread	40	1⅓ av slices	20	4	1
Fruit, Group V*	100	1 med apple—2½" d	15	1	0
Milk					
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter, or fat	24	1 T and 2 scant t	0	0	19
Total for Meal			67	21	32
TOTAL FOR DAY			201	60	100

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See "Equivalents and Substitutes"

Class III Diets • Menu No 607

Ratio Gm C to Gm F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of *carbohydrate protein,* and fat →		Carbohydrate 240 Gm, Protein 60 Gm, Fat 120 Gm } 2 280 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit Group VI*	150	¾ glass or 5 oz grape juice uns			
Cereal*	20	¾ scant c ck oatmeal (2⅔ T dry	15		
Egg	50	1 av			
Bacon crisp	10	2 thin strips—3¼" long			
Bread	60	2 av slices			
Milk	100	½ glass or 3⅓ oz			[illegible]
Cream—Coffee	50	3⅓ T or 1⅔ oz			
Butter or fat	16	1 full T			
Total for Meal			9	[illegible]	10
Noon					
American cheese					
Vegetable Group I*	100	1 large 3% vegetable salad			
Vegetable Group VI*	100	1 med potato boiled—2¼" d	18		
Bread	60	2 av slices			
Fruit Group IV*	150	3 med peach halves—2¼" d			
Milk	200	1 glass or 6⅔ oz	[illegible]		
Cream—Coffee	50	3⅓ T or 1⅔ oz			
Butter or fat	25	5 t	[illegible]		
Total for Meal			81	14	4
Evening					
Meat lean cooked*	30	1 slice lean beef—3½"x2½"x¼"	0		
Vegetable Group III*	100	¾ c diced carrots	9		
Vegetable Group VI*	100	1 med potato boiled—2¼" d	18	[illegible]	
Bread	40	1⅓ av slices	20	4	
Fruit Group V*	200	2 med apples—2¼" d	30		
Milk					
Cream—Coffee	50	3⅓ T or 1⅔ oz	[illegible]	1	1
Butter or fat	34	2 T and 1 scant t	0	0	[illegible]
Total for Meal			[illegible]9	22	40
TOTAL FOR DAY			239	61	120

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium k [illegible] ck uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable
*See "Equivalents and Substitutes

Class IV Diets • Menu No 580

Ratio Gm C to Gm F		3 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat →		Carbohydrate 150 Gm Protein 60 Gm. Fat 50 Gm. } 1,290 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit, Group IV*	100	1 med orange	12	1	0
Cereal*	20	⅓ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon, crisp	10	2 thin strips—3¼" long	0	2	5
Bread	30	1 av slice	15	3	1
Milk, skim	150	¾ glass or 5 oz	7	5	0
Cream—Coffee					
Butter, or fat	5	1 t	0	0	4
Total for Meal			49	19	16
Noon					
American cheese*	30	1⅓ slices—3¼"x2½"x⅛"	0	7	10
Vegetable, Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group III*	100	½ c young peas	9	3	0
Bread	30	1 av slice	15	3	1
Fruit, Group IV*	150	3 med peach halves—2½" d	18	1	0
Milk skim	120	1 4-oz glass	6	4	0
Cream—Coffee					
Butter, or fat	8	1⅔ t	0	0	6
Total for Meal			51	20	17
Evening					
Meat, lean, cooked*	30	1 slice lean beef—3⅛"x2½"x¼"	0	9	2
Vegetable, Group I*	100	¾ c green beans, cn.	3	2	0
Vegetable, Group III*	100	¾ c diced carrots	9	3	0
Bread	30	1 av slice	15	3	1
Fruit, Group IV*	150	3½ slices pineapple—⅛" tk, 3" d	18	1	0
Milk	100	½ glass or 3⅓ oz	5	3	4
Cream—Coffee					
Butter, or fat	12	2½ t	0	0	10
Total for Meal			50	21	17
TOTAL FOR DAY			150	60	50

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See 'Equivalents and Substitutes'

Class II Diets • Menu No 584

Rat o Gm C to Gm F	3 to 1	
DIET PRESCRIPTION Total da ly amount in grams of carbohydrate protein and fat	Carbohydrate 180 Gm Prote n 60 Gm Fat 60 Gm	1 500 Calor es

Meals	Gm	Household Measures	C	P	F
Morning					
Fru t Group IV*	150	¾ glass or 5 oz orange ju ce	18	1	0
Cereal*	20	⅓ scant c ck oatmeal (2⅔ T dry)	15		
Egg	50	1 av	0	[illegible]	6
Bacon crisp	10	2 thin str ps—3¼" long	0	[illegible]	5
Bread	40	1⅓ av sl ces	0	4	1
Milk	150	¾ glass or 5 oz			
Cream—Coffee					
Butter or fat	4	1 scant t	0		[illegible]
Total for Meal			60	20	21
Noon					
Amer can cheese*	20	1 sl ce—3¼"x2½"x⅛"	0	5	[illegible]
Vegetable Group I*	200	1 large 3% veg salad and ½ glass tom jc	6	4	0
Vegetable Group VI*	100	1 med potato boiled—2½" d	18	3	
Bread	40	1⅓ av sl ces	0	4	1
Fru t Group IV*	100	2 med peach halves—2⅝" d	1	1	0
M lk	100	⅓ glass or 3⅓ oz	5	3	4
Cream—Coffee					
Butter or fat	10	2 t	0	0	8
Total for Meal			61	20	19
Evening					
Meat lean cooked*	30	1 sl ce lean beef—3½"x2½"x¼"	0	9	[illegible]
Vegetable Group I*	50	1/6 head of head lettuce	1	1	0
Vegetable Group III*	100	¾ c d ced carrots	9	3	0
Bread	60	2 av sl ces	30	5	1
Fruit Group IV*	150	3¾ sl ces p neapple—¼" tk 3" d	18	1	0
Milk					
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	14	1 scant T	0	0	11
Total for Meal			59	20	20
TOTAL FOR DAY			180	60	60

ABBREVIATIONS Gm—Gram. C—Carbohydrate P—Prote n F—Fat. T—Tab espoon t easpoon oz—ounces. c—cup cn—canned ck—cooked d—d ameter av—average med—med um tk hick uns—unsweetened gl—glass tom—toma o jc—ju ce veg—vegetab e
*See "Equ valents and Subst tutes"

Class IV Diets • Menu No. 588

Ratio Gm C to Gm F		3 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat		Carbohydrate 210 Gm, Protein 60 Gm, Fat 70 Gm — 1,710 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit, Group IV*	150	¾ glass or 5 oz orange juice	18	1	0
Cereal*	20	⅔ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon					
Bread	50	1⅔ av slices	25	4	1
Milk, skim	200	1 glass or 6⅔ oz	10	7	0
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	14	1 scant T	0	0	11
Total for Meal			69	21	24
Noon					
American cheese					
Vegetable, Group I*	200	1 large 3% veg salad and ½ c tom jc	6	4	0
Vegetable, Group VI*	100	1 med potato, boiled—2½" d	18	3	0
Bread	50	1⅔ av slices	25	4	1
Fruit, Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter, or fat	10	2 t	0	0	8
Total for Meal			72	20	23
Evening					
Meat, lean, cooked					
Vegetable, Group I*	100	⅔ c green beans, cn	3	2	0
Vegetable, Group III*	150	1⅛ c diced carrots	13	4	0
Bread	50	1⅔ av slices	25	4	1
Fruit, Group IV*	150	3⅓ slices pineapple—¼" tk, 3" d	18	1	0
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter, or fat	10	2 t	0	0	8
Total for Meal			70	19	23
TOTAL FOR DAY			211	60	70

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See "Equivalents and Substitutes"

Class IV Diets • Menu No 592

Rat o Gm C to Gm F		3 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat		Carbohydrate 240 Gm, Protein 60 Gm, Fat 80 Gm — 1 920 Calor es			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fru t, Group IV*	200	1 glass or 6⅔ oz orange ju ce	24	2	0
Cereal*	25	½ c ck oatmeal (3⅓ T dry)	19	3	0
Egg	50	1 av	0	6	6
Bacon					
Bread	60	2 av slices	30	5	1
M lk	120	1 4 oz glass	6	4	5
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	10	2 t	0	0	8
Total for Meal			80	21	26
Noon					
Amer can cheese*	20	1 sl ce—3¼"x2½"x⅛	0	5	6
Vegetable Group I*	200	1 large 3% veg salad and ½ c tom jc	6	4	0
Vegetable Group VI*	100	1 med potato boiled—2½" d	18	3	0
Bread	60	2 av sl ces	30	5	1
Fru t Group IV*	200	4 med peach halves—2½" d.	24	2	0
Milk					
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter or fat	12	2½ t	0	0	10
Total for Meal			80	20	27
Evening					
Meat lean cooked					
Vegetable Group I*	100	¾ c green beans cn	3	2	0
Vegetable Group VI*	100	½ c corn cn	18	3	0
Bread	55	1 5/6 av sl ces	27	5	1
Fru t Group V*	150	1½ med apples—2½" d	22	1	0
Milk	200	1 glass or 6⅔ oz.	10	7	8
Cream—Coffee					
Butter or fat	22	1½ T	0	0	18
Total for Meal			80	18	27
TOTAL FOR DAY			240	59	80

ABBREVIATIONS Gm —Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon. t.—teaspoon oz —ounces c —cup cn —canned ck —cooked d —d ameter av —average med —medium. tk.—th ck uns.—unsweetened gl —glass tom —tomato jc —juice veg —vegetable
*See Equ valents and Subs tutes"

Class IV Diets • Menu No 600

Ratio Gm. C to Gm F	3 to 1	
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat →	Carbohydrate 300 Gm Protein 60 Gm Fat 100 Gm	2,340 Calories

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit, Group IV*	200	1 glass or 6⅔ oz orange juice	24	2	0
Cereal*	30	⅔ c ck oatmeal (4 T dry)	23	3	1
Egg					
Bacon					
Bread	80	2⅔ av slices	40	7	2
Milk	200	1 glass or 6⅔ oz	10	7	8
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter, or fat	15	1 T	0	0	12
Total for Meal			99	20	33
Noon					
American cheese					
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group VI*	200	2 med potatoes, boiled—2½" d	36	6	0
Bread	65	2⅙ av slices	32	6	2
Fruit Group IV*	200	4 med peach halves—2½" d	24	2	0
Milk	100	⅓ glass or 3⅓ oz	5	3	4
Cream—Coffee					
Butter or fat	35	2⅓ T	0	0	28
Total for Meal			100	19	34
Evening					
Meat, lean, cooked					
Vegetable, Group I*	100	¾ c green beans cn	3	2	0
Vegetable, Group VI*	200	1 c corn, cn	36	6	0
Bread	45	1½ av slices	22	4	1
Fruit, Group V*	200	2 med apples—2½" d	30	2	0
Milk	150	¾ glass or 5 oz	7	5	6
Cream—Coffee	50	3⅓ T or 1⅔ oz	2	1	10
Butter, or fat	20	4 t	0	0	16
Total for Meal			100	20	33
TOTAL FOR DAY			299	59	100

ABBREVIATIONS Gm—Gram. C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon. oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable.
*See "Equivalents and Substitutes"

Class V • Diets for Children

For Child Two Years Old

Ratio Gm C to Gm F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat ℞→		Carbohydrate 110 Gm, Protein 50 Gm, Fat 55 Gm } 1,135 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit, Group IV*	50	¼ glass or 1⅔ oz orange juice	6	0	0
Cereal					
Egg					
Bacon, crisp	10	2 thin strips—3½" long	0	2	5
Bread	20	⅔ av slice, toasted	10	2	0
Milk	300	1¼ glasses or 10 oz	15	10	12
Butter, or fat	5	1 t	0	0	4
10 a.m. *Fruit, Group IV**	50	¼ glass or 1⅔ oz orange juice	6	0	0
Total for Meal			37	14	21
Noon					
Meat, lean, cooked*	20	scraped or grnd meat patty—1"x1"x½"	0	6	1
Vegetable					
Vegetable, Group III*	50	¼ c young peas, chopped	4	1	0
Bread	20	⅔ av slice	10	2	0
Fruit, Group IV*	50	1 med peach half, diced—2½" d	6	0	0
Milk	120	1 4-oz glass	6	4	5
Butter, or fat	5	1 t	0	0	4
3 p.m. Milk	200	1 glass or 6⅔ oz	10	7	8
Total for Meal			36	20	18
Evening					
Cereal*	15	⅔ c ck. oatmeal (1⅓ T dry)	11	2	0
Vegetable					
Vegetable					
Bread	15	½ av slice, toasted	7	1	0
Custard†	110	1 av serving	4	4	4
Milk	300	1¼ glasses or 10 oz	15	10	12
Butter, or fat					
Total for Meal			37	17	16
TOTAL FOR DAY			110	51	55

ABBREVIATIONS Gm.—Gram C—Carbohydrate. P—Protein. F—Fat. T—Tablespoon t—teaspoon. oz.—ounces. c—cup cn—canned ck.—cooked d—diameter av—average med—medium. tk—thick. uns—unsweetened gl—glass tom.—tomato. jc.—juice veg—vegetable grnd—ground

*See "Equivalents and Substitutes."

†See recipe, page 150

Class V • Diets for Children

For Child Four Years Old

Ratio Gm C to Gm F	2 to 1
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat ⋙	Carbohydrate 130 Gm, Protein 60 Gm, Fat 65 Gm — 1 345 Calories

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit, Group IV*	100	1 med orange	12	1	0
Cereal*	20	½ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon crisp					
Bread	10	⅓ av slice	5	1	0
Milk, skim	200	1 glass or 6⅔ oz	10	7	0
Cream—Coffee					
Butter or fat	10	2 t	0	0	8
Total for Meal			42	17	14
Noon					
American cheese*	20	1 slice—3¼"×2¼"×⅛"	0	5	6
Vegetable Group I*	100	½ glass or 3⅓ oz tomato juice	3	2	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	25	5/6 av slice	12	2	1
Fruit Group IV*	50	1 med peach half—2½" d	6	0	0
Milk	300	1½ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter or fat	10	2 t	0	0	8
Total for Meal			45	22	27
Evening					
Meat lean cooked*	20	1 slice lean beef—2¼"×2¼"×¼"	0	6	1
Vegetable Group I*	100	¾ c green beans cn	3	2	0
Vegetable Group III*	50	½ c diced carrots	4	1	0
Bread	30	1 av slice	15	3	1
Fruit Group IV*	50	1¼ slices pineapple—¼" tk, 3" d	6	0	0
Milk	300	1½ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter or fat	12	2½ t	0	0	10
Total for Meal			43	22	24
TOTAL FOR DAY			130	61	65

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See "Equivalents and Substitutes

Class V • Diets for Children

For Child Six Years Old

Ratio Gm C to Gm. F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat ⇛		Carbohydrate 150 Gm. / Protein 70 Gm. / Fat 75 Gm. } 1 555 Calories			
Meals	**Gm**	**Household Measures**	**C**	**P**	**F**
Morning					
Fruit Group IV*	100	1 med orange	12	1	0
Cereal*	20	½ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon crisp	10	2 thin strips—3¼" long	0	2	5
Bread	25	5/6 av slice	12	2	1
Milk skim	250	1¼ glasses or 8⅓ oz	12	9	0
Cream—Coffee					
Butter or fat	10	2 t	0	0	8
Total for Meal			**51**	**22**	**20**
Noon					
American cheese*	30	1½ slices—3½"x2½"x⅛"	0	7	10
Vegetable Group I*	50	1 small 3% vegetable salad	1	1	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	25	5/6 av slice	12	2	1
Fruit Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	300	1½ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter or fat	10	2 t	0	0	8
Total for Meal			**49**	**24**	**31**
Evening					
Meat lean cooked*	20	1 slice lean beef—2¼"x2¼"x¼"	0	6	1
Vegetable Group I*	100	¾ c green beans cn	3	2	0
Vegetable Group III*	50	⅜ c diced carrots	4	1	0
Bread	45	1½ av slices	22	4	1
Fruit Group IV*	50	1¼ slices pineapple—¼" tk 3" d	6	0	0
Milk	300	1½ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter or fat	12	2½ t	0	0	10
Total for Meal			**50**	**23**	**24**
TOTAL FOR DAY			**150**	**69**	**75**

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T Tablespoon t—teaspoon. oz—ounces c—cup cn—canned k—cooked d diameter av—average med—medium tk.—thick. uns.—unsweetened gl—glass. tom—tomato jc—juice veg—vegetable

*See Equivalents and Substitutes.

Class V • Diets for Children

For Child Ten Years Old

Ratio Gm C to Gm F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate protein and fat →→		Carbohydrate 190 Gm, Protein 85 Gm, Fat 95 Gm } 1 955 Calories			

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit, Group IV*	100	1 med orange	12	1	0
Cereal*	20	¾ scant c ck oatmeal (2⅔ T dry)	15	2	0
Egg	50	1 av	0	6	6
Bacon crisp	15	3 thin strips—3¼" long	0	4	8
Bread	45	1½ av slices	22	4	1
Milk	300	1½ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter or fat	10	2 t	0	0	8
Total for Meal			64	27	35
Noon					
American cheese*	30	1¼ slices—3¼"x2¼"x¼"	0	7	10
Vegetable Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable Group III*	100	½ c young peas	9	3	0
Bread	50	2 av slices	25	4	1
Fruit Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	300	1½ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter, or fat	12	2½ t	0	0	10
Total for Meal			64	27	33
Evening					
Meat lean cooked*	45	1 slice lean beef—4½"x2¼"x¼"	0	13	3
Vegetable Group III*	100	½ c diced carrots	9	1	0
Vegetable Group VI*	100	1 med potato, boiled—2½" d	18	3	0
Bread	30	1 av slice	15	3	1
Fruit, Group IV*	50	1½ slices pineapple—½" tk, 3" d	6	0	0
Milk	250	1¼ glasses or 8⅓ oz	12	9	10
Cream—Coffee	30	2 T or 1 oz	1	1	6
Butter or fat	10	2 t	0	0	8
Total for Meal			61	32	28
TOTAL FOR DAY			189	86	96

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See Equivalents and Substitutes

Class V • Diets for Children

For Child Fifteen Years Old

Ratio Gm C to Gm F		2 to 1			
DIET PRESCRIPTION Total daily amount in grams of carbohydrate, protein, and fat →		Carbohydrate 240 Gm, Protein 110 Gm, Fat 120 Gm — 2 490 Calories			

Meals	Gm	Household Measures	C	P	F
Morning					
Fruit, Group IV*	100	1 med orange	12	1	0
Cereal*	30	⅔ c ck oatmeal (4 T dry)	23	3	1
Egg	100	2 av	0	13	11
Bacon, crisp	15	3 thin strips—3½" long	0	4	8
Bread	60	2 av slices	30	5	1
Milk	300	1⅓ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter, or fat	15	3 t	0	0	12
Total for Meal			80	36	45
Noon					
American cheese*	45	1 slice—3½"x3½"x¼"	1	11	14
Vegetable, Group I*	100	1 large 3% vegetable salad	3	2	0
Vegetable, Group III*	200	1 c young peas	18	6	0
Bread	60	2 av slices	30	5	2
Fruit, Group IV*	100	2 med peach halves—2½" d	12	1	0
Milk	300	1⅓ glasses or 10 oz	15	10	12
Cream—Coffee					
Butter, or fat	15	3 t	0	0	12
Total for Meal			79	35	40
Evening					
Meat, lean, cooked*	60	2 slices lean beef—3½"x2½"x¼"	0	18	4
Vegetable, Group III*	100	¾ c diced carrots	9	3	0
Vegetable, Group VI*	100	1 med potato boiled—2½" d	18	3	0
Bread	60	2 av slices	30	5	1
Fruit, Group IV*	100	2½ slices pineapple—¼" tk 3" d	12	1	0
Milk	250	1⅛ glasses or 8⅓ oz	12	9	10
Cream—Coffee					
Butter or fat	25	5 t	0	0	20
Total for Meal			81	39	35
TOTAL FOR DAY			240	110	120

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable

*See "Equivalents and Substitutes"

OPTIMAL DAILY DIETARY ALLOWANCES

(Food and Nutrition Board, National Research Council, 1948)

	Calories (Suggested Average)	Protein in Gm.	Calcium in Gm	Iron in mg.	Vitamins: A in I U *	Thiamin in mg †	Riboflavin in mg	Niacin in mg	C in mg †	D in I U
Man (154 lb 70 Kg.)										
Sedentary	2 400	70	1	12	5 000	1.2	1.8	12	75	‡
Physically active	3 000	70	1	12	5 000	1.5	1.8	15	75	‡
Heavy work	4 500	70	1	12	5 000	1.8	1.8	18	75	‡
Woman (123 lb 56 Kg)										
Sedentary	2,000	60	1	12	5 000	1.0	1.5	10	70	‡
Moderately active	2 400	60	1	12	5 000	1.2	1.5	12	70	‡
Very active	3 000	60	1	12	5 000	1.5	1.5	15	70	‡
Pregnancy (latter half)	2 400	85	1.5	15	6 000	1.5	2.5	15	100	400
Lactation	3 000	100	2.0	15	8 000	1.5	3.0	15	150	400
Children up to 12 yrs										
Under 1 yr §	50/lb	1.5/lb	1.0	6	1 500	0.4	0.6	4	30	400
1 3 yrs. (27 lb 12 Kg)	1 200	40	1.0	7	2 000	0.6	0.9	6	35	400
4-6 yrs. (42 lb 19 Kg) ¶	1 600	50	1.0	8	2 500	0.8	1.2	8	50	400
7 9 yrs. (58 lb 26 Kg)	2 000	60	1.0	10	3 500	1.0	1.5	10	60	400
10 12 yrs. (78 lb., 35 Kg)	2 500	70	1.2	12	4 500	1.2	1.8	12	75	400
Children over 12 yrs.										
Boys										
13 15 yrs. (108 lb., 49 Kg)	3 200	85	1.4	15	5 000	1.5	2.0	15	90	400
16 20 yrs. (141 lb., 64 Kg)	3 800	100	1.4	15	6 000	1.7	2.5	17	100	400
Girls										
13 15 yrs. (108 lb 49 Kg)	2 600	80	1.3	15	5 000	1.3	2.0	13	80	400
16 20 yrs (122 lb 55 Kg)	2 400	75	1.0	15	5 000	1.2	1.8	12	80	400

These are tentative allowances toward which to aim in planning practical dietaries. These allowances can be met by a good diet of natural foods this will also provide other minerals and vitamins, the requirements for which are less well known

*Requirements may be less than these amounts if provided as vitamin A and greater if provided chiefly as the provitamin carotene

†One mg of thiamin equals 333 International units, 1 mg of ascorbic acid equals 20 International units (1 International unit equals 1 U S P unit)

‡Vitamin D is undoubtedly necessary for older children and adults When not available from sunshine, it sho... be provided probably up to the minimal amounts recommended for infants

Recommendations, adopted 1942

...of body weight.

...ants and children re-

...ion needs to be given

...very or to the infant

VITAMIN VALUE OF FOODS

	A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	D
FOODSTUFFS	U S P or International Units	Milligrams per 100 Grams				U S P or International Units
Meat and Meat Substitutes						
Bacon	25	0 37–0 48	0 13–0 31	1 3–4 2		
Beef (lean)	0–50	0 07–0 2	0 2*	4 5–6 5		
Chicken						
White		0 08–0 09	0 12	7 3–9 5		
Dark		0 09–0 15	0 25–0 34	3 0–6 0		
Egg						
Yolk	1,800–3,000	0 35–0 48	0 5–0 8	0 04		140–390
White			0 4–0 7	0 08		
Fish						
Cod	5	0 1*	0 08	2 3	2	
Halibut		0 08*	0 07*	6–11		
Oyster	140–210	0 18	0 22	1 2–1 3		5
Salmon (canned)	25–800	trace–0 11				190–800
Sardine (canned)	130–415	0 03	0 48	2 0–3 5		290–1,850
Lamb (lean)		0.24–0 44	0 18–0 33	5 6–8 5		
Liver						
Beef	30,200*	0 23–0 33	1 5–3 5	11 8–22 7	31*	47
Calf	52,600–159,800	0 15–0 21	1 4–4 3	13 2–19 5	33*	17
Chicken	ca 40,000	0 23	1 1–3 3	8 0	ca 35	50
Lamb	67,600–113,100	0.23–0 41	2 6–5 4	17 2	ca 38	17
Pork	27,800*	0 15–0 3	1 8–2.7	16 7–29 8	12*	44
Pork						
Lean		1 4–1 8	0 19–0 27	5 6–8 4		
Ham (smoked)		1 3–1 4	0 23–0 29	3 9–8 2		
Veal (lean)		0 12–0 43	8 9	0 24		
Dairy Products						
Butter	3 000–5,900					8–100
Cheese						
Brick	1,400			0 1		
Cheddar	1,500*	0 03*	0 4–1 4	0 02–0 2		
Cottage	190–730					
Cream	2,100–2,300		0 14–0 2	0 06		
Swiss	1,900–2,700		0 4–0 6	0 07		

*Average

VITAMIN VALUE OF FOODS—continued

	A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	D
FOODSTUFFS	U S.P or International Units	Milligrams per 100 Grams				U S P or International Units
Cream (20%)	600–1 600	0 03				50
Milk						
Whole	87–230	0 03–0 06	0 1–0 3	0.07–0 1	1 2	0 10
Evaporated	460	0 04–0 05		0 18	1 15	
Nuts						
Almond	0–75	0 24*	0 5	1 8		
Coconut		0 03		0 4	1	
Peanut		0 9–1 0	0 1–0 6	5 9–8 6		
Peanut butter		0 2–0 3		18 6		
Pecan	200–400	1 0	0 25			
Walnut (English)	100	0 45				
Cereals						
Bread						
Rye	trace	0 16–0 21	0 07	0 9		
White	trace	0 05–0 06	0 05–0 09	0 6–1 0		
White (enriched)	trace	0 24–0 48	0 13–0 26	0 6–4 4		
Whole wheat	trace	0 23–0 3	0 07–0 12	0 9 2 8		
Buckwheat		0 60*		4 4		
Cornmeal						
White		0 30	0 06	0 18–0 90		
Yellow	550	0 23	0.04	0 10–0 60		
Farina		0 07–0 13		1 0		
Flour						
Rye		0 14		0 73–1.22		
White (patent)		0 05		0 80		
Whole wheat		0 48–0 69		0 60*		
Oatmeal (quick-cooking)		0 81				
Rice						
Brown		0 23–0 42	0 08–0 12	0 60		
Polished		0 025	0 05	0 65–0 90		
Wheat						
Whole grain	trace	0 35–0 67	0 09–0 16	4 0–4 6		
Bran		1 4		4 2		
Fruits						
Apple	58–147	0 05*	0 02–0 07	0 05–0 09	3–6	
Apricot						
Fresh	4 000	0 03–0 06	0 04–0 09	0 14	0–6	
Dried	5 400*	0 09–0 17	0 09–0 17		3–8	

*Average

VITAMIN VALUE OF FOODS—continued

	A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	D
FOODSTUFFS	USP or International Units	Milligrams per 100 Grams				USP or International Units
Banana	420*	0 05–0 16	0 07	0 6	5–11	
Blackberry	83 560	0 03*			3–7	
Cantaloupe						
(edible portion)	2 390	0 05–0 2	0 03–0 07	1 0	30–40	
Cherry	200	0 05		0 14	140	
Cranberry	20–70			0 13	0–12	
Date (cured)	150	0 08	0 03			
Figs (dried)	60–115	0 07–0 3		1 7		
Gooseberry	380				25–35	
Grape (average)	trace	0 06	0 06	0 28–0 84	2 7	
Grapefruit		0 07–0 15	0 03	0 15–0 21	32–56	
Juice (fresh)		0 03–0 08	0 01	0 15–0 21	45	
Juice (canned)					3–43	
Lemon juice						
Fresh		0 03		0 08	38 100	
Canned					52*	
Lime juice					30–38	
Olive						
Green	190 1 000					
Ripe	125					
Orange	65 250	0 07–0 1	0 03–0 05	0 17–0 30	20–77	
Juice (fresh)	45–350	0 07–0 2	0 01–0 02	0 15–0 22	22–82	
Juice (canned)					30–42	
Peach (average)	300–3 000	0 03–0 12		0 95	0 06	
Dried	2 400–3 400					
Pear	10–50	0 04	0 07	0 1–0 9	0 8–9 0	
Pineapple						
Fresh	100–200	0 03–0 09	0 05–0 08		25–45	
Canned					14	
Juice (canned)					15–30	
Plum	360	0 05–0.2	0 04	0 6	2 10	
Prune						
Fresh	1 000		0 03		1–2	
Dried	1,400–3 500	0 11–0 18		0 4–0 5		
Raspberry	130	0 03			25	
Strawberry	50	trace	trace	0 2–0 3	35–140	
Watermelon	500	0 03–0 07	0 03–0 07	0 2	2–10	
Vegetables						
Artichoke	200	0 2–0 3			6–9	

*Average

VITAMIN VALUE OF FOODS—continued

FOODSTUFFS	A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	D
	U S P or International Units	Milligrams per 100 Grams				U S P or International Units
Cream (20%)	600–1,600	0 03				50
Milk						
Whole	87–230	0 03–0 06	0 1–0 3	0 07–0 1	1–2	0–10
Evaporated	460	0 04–0 05		0 18	1–1 5	
Nuts						
Almond	0–75	0 24*	0 5	1 8		
Coconut		0 03		0 4	1	
Peanut		0 9 1 0	0 1–0 6	5 9–8 6		
Peanut butter		0 2–0 3		18 6		
Pecan	200–400	1 0	0 25			
Walnut (English)	100	0 45				
Cereals						
Bread						
Rye	trace	0 16–0 21	0 07	0 9		
White	trace	0 05–0 06	0 05–0 09	0 6–1 0		
White (enriched)	trace	0 24–0 48	0 13–0 26	0 6–4 4		
Whole wheat	trace	0 23–0 3	0 07–0 12	0 9–2 8		
Buckwheat		0 60*		4 4		
Cornmeal						
White		0 30	0 06	0 18–0 90		
Yellow	550	0 23	0 04	0 10–0 60		
Farina		0 07–0 13		1 0		
Flour						
Rye		0 14		0 73–1 22		
White (patent)		0 05		0 80		
Whole wheat		0.48–0 69		0 60*		
Oatmeal (quick-cooking)		0 81				
Rice						
Brown		0 23–0 42	0.08–0 12	0 60		
Polished		0 025	0 05	0 65–0 90		
Wheat						
Whole grain	trace	0 35–0 67	0 09–0 16	4 0–4 6		
Bran		1 4		4 2		
Fruits						
Apple	58–147	0 05*	0 02–0 07	0 05–0 09	3–6	
Apricot						
Fresh	4,000	0 03–0 06	0 04–0 09	0 14	0–6	
Dried	5,400*	0 09–0 17	0 09–0 17		3–8	

*Average

VITAMIN VALUE OF FOODS—*continued*

	A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	D
FOODSTUFFS	U S P or International Units	*Milligrams per 100 Grams*				U S P or International Units
Onion						
Chives					40–55	
Mature		0 02–0 03	0 1–0 2	0 1–0 2		
Parsley	30 000				100 200	
Parsnip					6–40	
Pea (green fresh)	600 3 300	0 4–0 45	0 1–0 2	0 7 1 8	16 50	
Pepper						
Green	800 7 700	0 06	0 14	0 2	100 230	
Red					180 280	
Potato						
Sweet	2 000 3 800	0 09	0 07	1 3 (peeled)	8 25	
White	30 50	0 14–0 19	0 04–0 6	0 4 1 4	7 25	
Pumpkin	2 500	0 05	0 04	0 7	4	
Radish		0 02–0 06	0 03–0 04	0 1–0 16	20 30	
Rhubarb		0 01			9–45	
Rutabaga	0 25	0 05–0 08			20 3[illegible]	
Sauerkraut	25	0 03	0 04	0 2	20 35	
Juice		0 01			8	
Spinach	6 600 25 000	0 1	0 2	0 5–0 8	30 120	
Squash						
Summer	1 000	0 04–0 07	0 04			
Winter	4 000	0 05–0 07	0 05–0 06		2	
Tomato	1 000	0 06–0 08	0 04–0 05	0 3–0 6	20 30	
Juice	1 000	0 08			20 50	
Turnip	0–40	0 03–0 06	0 03–0 07	0 7 1 0	30 55	
Greens	15 700	0 06–0 14	0 04		70–420	
Water cress	4 000	0 13	0 23		55 190	
Miscellaneous						
Chocolate	0–60	0 03–0 5	0 2	1 0		
Coconut oil						
Corn oil (refined)						
Cottonseed oil (refined)						
Lard						
Molasses		trace–0 6	trace–0 3	3 9		
Olive oil						
Peanut oil						

VITAMIN VALUE OF FOODS—continued

	A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	D
FOODSTUFFS	U S P or International Units	Milligrams per 100 Grams				U S P or International Units
Asparagus						
Green (fresh)	370–1,400	0 2	0 1	1 0	18–80	
Green (canned)		0 07			2–5	
Beans						
Green (snap)	750	0 06–0 09	0 09	0 5*	2–45	
Kidney (dry)		0 3–0 7		2 0		
Lima (fresh)	400–2 000	0 2–0 3	0 1–0 3	0 3–1 0	30–40	
Lima (dry)	0–100	0 5	0 1–0 8	1 0–2 0		
Navy (dry)		0 4–0 8	0 3			
Soy						
Green	350–1,175	0 5	0 4	4 0	20–40	
Mature	0–406	1 0 1 5	0 2	2 0		
Wax	500–1,000	0 09	0 09	0 7*	15–20	
Beet greens	16,100	0 1	0 08–0 38	0 3–0 7	30–50	
Broccoli	1,300–9,000	0 1	0 2	0 9*	80–170	
Brussels sprouts	200 300	0 2			50–180	
Cabbage	0 120	0 04–0 08	0 04–0 07	0 2–0 3	25–160	
Chinese	2 000	0 06–0 08			30–40	
Red	40				35–60	
Savoy					15–55	
Carrot	1,700–10 000	0 06	0 07	0 2–1 5	5–10	
Cauliflower	30–260	0 2	0 06	0 5	40–105	
Celery						
Green	580–670					
Bleached	0–10	trace	trace	0 2–0 3	5–10	
Chard	9,000		0 08–0 14		35–45	
Corn (sweet)	280 2 500	0 12–0 2	0 05–0 12	1 3	6–43	
Cucumber	0–20	0 05	0 04	0 1–0 3	2–10	
Dandelion greens	13,000*	0 2			30–155	
Eggplant		0 05	0 03	0 6	2–12	
Endive	3,800–27,000	0 06–0 1	0 06–0 2	0 7	10–20	
Kale	10,500	0 2	0 5		50–150	
Kohlrabi		0 06		0 3	65	
Lettuce						
Head	100–700	0 04–0 09	0 03–0 05	0 1–0 5	5 20	
Leaf	7,500		0 07–0 1			
Mushroom		0 09–0 15	0 03–0 2	6 9	8	
Mustard greens	10,200	0 1	0 04		60–180	
Okra	400–2,380	0 13		0 7	10–20	

*Average

PERCENTAGE OF VITAMIN LOSS DURING FOOD PREPARATION—continued

FOODSTUFFS	Thiamin Chloride	Ascorbic Acid	Nicotinic Acid	Riboflavin
Beans—cont				
String sliced,				
steam				
blanched				
3 min.		36		
water				
blanched				
3 min.		46		
Runner				
sliced				
water				
blanched				
3 min		53		
Beets	92		11–61	18
Broccoli	44 57	47–64	23–64	33–37
Brussels				
sprouts				
water				
blanched				
3 min		13 35		
Cabbage	52	21–84	19 23	16
Carrots	65	50	12 29	50
Cauliflower		35	16	13–17
Corn on cob		8		
Greens				
Beet			6	14
Turnip		30		
Kale		60		
Onions	37	10–65		26
Parsnips		44		
Peas	25–46	32 50	20 5	31 50
Potatoes				
Peeled				
boiled.	35	12	26	44
Unpeeled				
whole				
baked		49		
Stored				
180 days				
Boiled then				
creamed		89		
Boiled then				
fried		88		
Boiled then				
mashed		74		
French fried		63		
Scalloped		80		
Sweet baked	62		4	13
Rhubarb		48		
Sauerkraut	56		5+	5
Spinach	33–64	84 90	16 27	5–40
Squash				
Summer boiled		40 7		
Turnips	26	39	40	10

The above figures are based on the vitamin loss of natural food Many other factors contribute to [illegible] loss of the foods listed among these factors are processing storage seasonal and cooking variations, [illegible] used acidity or alkalinity of the cooking media condition of the food at time of preparation [illegible] the cooking time, and degree of temperature employed

PERCENTAGE OF VITAMIN LOSS DURING FOOD PREPARATION

FOODSTUFFS	Thiamin Chloride	Ascorbic Acid	Nicotinic Acid	Riboflavin
Meat and Meat Substitutes				
Bacon	60			8+
Beef				
Chuck roasted including juices	9			
Heart			13 15	
Liver fried			30	
Plate boiled cooking water included	45			
Round	14		5+	22
Chicken				
Breast meat				
Fried			42	
Roasted			29	
Steamed			38	
Leg meat				
Fried			48	
Roasted			33	
Steamed			45	
Stewed cooking water included	72			
Eggs	13		25	22
Fish				
Flounder fried	11			
Halibut	21		2-5+	22
Salmon			7	
Ham	28		21	
Lamb				
Heart baked			56	
Leg roasted	45		27	15
Sirloin broiled	30		20	21
Stew	73		49	30
Pork				
Chops, fried	15		43	
Liver fried			25	
Pork—cont				
Loin	41		32 72	17 33
Veal				
Chop			8+ 13	
Leg roasted	42		21	17
Rib braised	60		37	27
Shoulder roasted	44		17	14
Sirloin braised.	44		17	14
Stew	75		49	34
Dairy Products				
Milk pasteurized	10–20	18–60		39–48
Fruits				
Apples				
Baked		80		
Sauce	37	75		25
Prunes	61			
Vegetables				
Artichokes		43		
Asparagus			11	
Beans				
Broad water blanched 6 min		34	11	
Green snap	20–64	70–80	20–50	25
Lima			11	
String whole steam blanched 3 min.		18		
water blanched 3 min.		12		

The above figures are based on the vitamin loss of natural food. Many other factors contribute to the vitamin loss of the foods listed; among these factors are processing, storage, seasonal and cooking variations, condiments used, acidity or alkalinity of the cooking medium, condition of the food at time of preparation, length of the cooking time and degree of temperature employed.

VEGETABLES

Group I (Approximately 3% Carbohydrate)

	100 Grams	*Approx Measure*
A 100 Gm portion	Asparagus fr	10 to 1
contains approximately	Asparagus cn	½ c up
C 3 P 2 F 0 = 20 Cal	Bamboo shoots fr	¾ c
	Beans green or wax cn	¾ c 1
	Beet greens fr	½ c ck
	Broccoli fr	3 stalks
	Cabbage fr raw	1 c s
	Cabbage fr	² k
	Cabbage Chinese fr raw	
	Cauliflower fr or cn	3 s
	Celery fr raw	2 lg
	Celery ck	₃ c
	Chard fr	²
	Chicory leaves fr	10
	Corn salad fr	c
	Cress garden fr	2 c
	Cucumber	1
	Dock fr	2
	Endive fr	2 sta k
	Escarole fr	²₃
	Fennel fr	²
	Lettuce fr	¼ 4
	Mung bean sprouts fr	1 n
	Mustard greens fr	½ k
	Pokeberry or poke shoots	½ c }
	Radishes fr	1 1
	Rhubarb fr or cn w p	²₃
	Sauerkraut fr or cn	
	Sea kale fr	1 k
	Sorrel fr	² c
	Spinach, fr	⅔ k
	Spinach cn	½
	Squash summer fr	½ c
	Tomato, fr raw	1 med
	Tomatoes cn	½
	Tomato jc fr or cn	½ gl
	Turnip tops fr	½ k
	Vegetable marrow fr	½ c
	Water cress, fr	1 b n h

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat ... oz—ounces c—cup cn—canned ck—cooked d—diameter av—average ... unsweetened gl—glass tom—tomato jc—juice veg—vegetable ... packed jp—juice-packed fr—fresh dr—dried sm—small lg—large

LIST OF FOODS

Grouped According to Approximate Percentage Composition of Carbohydrate, Protein, and Fat

(Based on Tables of U S Department of Agriculture)

Average Values for Calculation of Carbohydrate, Protein, and Fat of Fruits and Vegetables in the Several Groups (Fresh or Water-Packed)

Group Number	Carbohydrate	Fruits			Vegetables		
		Protein	Fat	Cal.	Protein	Fat	Cal
	%	%	%		%	%	
I	3	1	0.3	12	2	0.3	20
II	6	1	0.3	28	2	0.3	32
III	9	1	0.3	40	3	0.3	50
IV	12	1	0.3	52	4	0.3	64
V	15	1	0.3	64	3	0.3	75
VI	18	1	0.3	76	3	0.3	85

Fresh, canned, and dried fruits and vegetables are included in these lists A serving is to be considered as the solid portion with its share of liquor from the can Of the canned fruits, only the water-packed and the juice-packed products come in the six classified groups Fruits canned in syrup are high in carbohydrate and are therefore placed in the miscellaneous group, where they are listed collectively

Dried fruits, as such, also appear in this miscellaneous group They average about 67 percent of carbohydrate, but when they are stewed for serving, dilution lowers this figure If the fruit is cooked without the addition of sugar and with enough water so that the finished product weighs about *four times* as much as the dried fruit used, then the dilution will be such that the cooked fruit may be classified in the 18 percent group

Dried vegetables, represented by dry legumes and dried corn, fall in the miscellaneous high-carbohydrate group Even fresh green corn and fresh peas may be placed in this group if they are not sufficiently young Only *very young* green corn and only *young* or medium peas are low enough in carbohydrate to be included in the classified lists

Mushrooms and algae are not included in these lists since their content of available carbohydrate is negligible Avocados, though not high in carbohydrate, are not listed because their fat content is extremely variable and is likely to be very high

Group V (Approximately 15% Carbohydrate)

	100 Grams	Approximate Household Measures
A 100 Gm. portion contains approximately C15 P3 F0=75 Cal	Beans, broad green, shelled	[illegible] c
	Beans, red kidney, cn	[illegible] c
	Corn, fr (very young)	[illegible] c ck
	Jerusalem artichoke, tuber, fr	1 lg tub
	Onions, top, fr	[illegible]
	Parsnips, fr	1 med [illegible]
	Peas, fr (med mature)	[illegible] c
	Salsify, fr	2 [illegible]
	Shallot, fr	32 sm

Group VI (Approximately 18% Carbohydrate)

	100 Grams	Approximate Household Measures
A 100-Gm. portion contains approximately C18, P3 F0=85 Cal	Beans, baked cn	[illegible]
	Corn sweet, cn	[illegible]
	Garlic, fr	[illegible]
	Horse-radish, fr	[illegible]
	Potato fr	[illegible]

FRUITS

Group I (Approximately 3% Carbohydrate)—None

Group II (Approximately 6% Carbohydrate)

	100 Grams	Approximate Household Measures
A 100 Gm. portion contains approximately C6 P1 F0=28 Cal	Blackberries, cn, w p	[illegible] c
	Cantaloupe	[illegible]
	Chayote, fruit, fr	[illegible] c
	Gooseberries, cn, w p	[illegible] c
	Honeydew melon	1" wedge
	Spanish melon	[illegible]
	Muskmelon	[illegible] d
	Peaches, cn, w p	2 med halves
	Plums (excluding prunes), cn, w p	3 med
	Strawberries, fr	[illegible] c
	Strawberries, cn, w p or j p	[illegible] c
	Strawberry juice, fr	[illegible] gl or [illegible]
	Watermelon, fr	e p—[illegible]

Group III (Approximately 9% Carbohydrate)

	100 Grams	Approximate Household Measures
A 100-Gm. portion contains approximately C9, P1, F0=40 Cal	Applesauce cn, uns	[illegible] c
	Apricots, cn, w p	3 med
	Blackberries, fr	[illegible] c

ABBREVIATIONS Gm.—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz.—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns.—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water packed j p—juice-packed fr—fresh dr—dried sm—small lg—large

VEGETABLES—*continued*

Group II (Approximately 6% Carbohydrate)

	100 Grams	*Approximate Household Measures*
A 100 Gm portion contains approximately C 6, P 2, F 0 = 32 Cal	Beans, snap, fr, green or wax, fr	¾ c.—1" pieces
	Carrots, cn	⅔ c, cubed
	Celery root or celeriac, fr	¾ c, sliced
	Chives, fr	1 c, chopped
	Collards, fr	½ c, ck
	Dandelion greens, fr	½ c, ck
	Eggplant, fr	1 c, diced, or 1 slice—4½"×½"
	Kale, fr	⅔ c, ck
	Kohlrabi, fr	½ to ⅔ c, diced
	Lamb's-quarters, fr	½ c, ck.
	Leeks, fr	1 c.—½" pieces
	Okra, fr	½ c, sliced, or 5 pods
	Parsley, fr	100 av sprigs
	Pepper, green or red, fr	1 med
	Pumpkin, fr	½ c, diced
	Pumpkin and squash, cn	½ c, diced
	Soybeans, green, shelled, fr	½ c.
	Soybean sprouts, fr	⅔ c
	Squash, cushaw, fr	⅘ c, diced
	Squash, winter, fr	⅔ c, ck
	Turnips fr	½ c, diced

Group III (Approximately 9% Carbohydrate)

	100 Grams	*Approximate Household Measures*
A 100 Gm portion contains approximately C 9, P 3 F 0 = 50 Cal	Artichoke, globe or French, fr	1 med
	Asparagus beans pods, fr	1 c
	Beets, fr or cn	½ c, diced
	Brussels sprouts, fr	6—about 1½" d
	Carrots, fr	⅔ c, sliced
	Onions, fr	2 to 3 sm or 1 lg
	Peas, fr (very young)	¾ c
	Peas, cn	½ c
	Rutabagas, fr	½ c, ck

Group IV (Approximately 12% Carbohydrate)

	100 Grams	*Approximate Household Measures*
A 100 Gm portion contains approximately C 12, P 4, F 0 = 64 Cal	Beans, Lima, green, cn	½ c

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck.—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water packed j p—juice packed fr—fresh dr—dried sm—small lg—large

Group IV—*continued*

	100 Grams	*Approximate Household Measures*
	Kumquats fr	5 med
	Loganberries fr	¾ to 1 c.
	Loganberries cn j p	½ c
	Mulberries fr	⅔ c
	Orange fr	1 med.—2½" d
	Orange juice fr or cn	½ gl or 3½ oz
	Peaches fr	1 med.—2½" d.
	Peach juice fr	½ gl. or 3½ oz
	Pear, cn j p	1 med
	Pineapple fr or cn w p	2½ slices—¾" tk, 3" d.
	Pineapple juice fr or cn	½ gl or 3½ oz
	Plums fr (excluding prunes)	3—1½" d
	Quince fr	½—3"x2½"
	Raspberries fr	¾ c
	Raspberries cn j p	½ c
	Raspberry juice fr	½ gl or 3½ oz

Group V (Approximately 15% Carbohydrate)

	100 Grams	*Approximate Household Measures*
A 100 Gm portion contains approximately C 15 P 1 F 0 = 64 Cal	Apples fr	1—2½" d
	Blueberries fr	⅔ c.
	Blueberry juice fr	½ gl or 3½ oz
	Cherries black cn. w p	½ c or 10 lg pitted
	Grapes fr	1 av bunch or 24 grapes
	Huckleberries fr	⅔ c
	Huckleberry juice fr	½ gl or 3½ oz
	Mango fr	1 sm
	Nectarines fr	2 med
	Papaws fr	2—4" long
	Pear fr	1 med
	Pineapple cn j p	2 slices—¾" tk 3" d

Group VI (Approximately 18% Carbohydrate)

	100 Grams	*Approximate Household Measures*
A 100 Gm portion contains approximately C 18 P 1 F 0 = 76 Cal	Cherries sweet fr	½ c or 15 cherries
	Cherries black cn j p	⅓ c with 1 T jc.
	Crab apples fr	2 sm.
	Figs fr	2 med —1½" d
	Grape juice fr or bottled	½ gl or 3½ oz
	Persimmon Japanese	1 lg
	Pomegranate fr	½—6½" d
	Prunes cn j p	3 med with 1 T jc
	Prune juice cn	½ gl or 3½ oz

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d diameter av average med medium tk thick uns.—unsweetened gl—glass tom—tomato jc—juice veg vegetable e p—edible portion w p water packed j p—juice-packed fr—fresh dr—dried sm small lg large

FRUITS—*continued*

Group III—*continued*

100 Grams	Approximate Household Measures
Blackberries, cn, j p.	½ c
Blackberry juice, fr	½ gl or 3½ oz
Blueberries, cn, w p	½ c
Blueberries, cn, j p	½ c
Cherries, red or white, cn, w p	½ c
Cranberries, fr	1 c, raw
Currants, fr	½ c
Currant juice, fr	½ gl or 3½ oz
Gooseberries, fr	⅔ to 1 c
Grapefruit, fr	½—4" d, or ½ c sections
Grapefruit, cn, w p	½ c sections
Grapefruit, cn, j p	½ c sections
Grapefruit juice, fr	½ gl or 3½ oz
Lemons, fr	2—2¼" long (e p)
Lemon juice, fr or cn	½ gl or 3½ oz
Limes, fr	3 med (e p)
Lime juice, fr	½ gl or 3½ oz
Loganberries, cn, w p	½ c
Loganberry juice, fr	½ gl or 3½ oz
Papaya, fr	¼—5" d
Peaches, cn, j p	2 med halves—2½" d
Pears, cn, w p	2 med halves
Prunes, cn, w p	4 med
Quince juice, fr	½ gl or 3½ oz
Raspberries, cn, w p	½ c.
Tangerines, fr	2—2" d
Tangerine juice, fr	½ gl or 3½ oz

Group IV (Approximately 12% Carbohydrate)

A 100 Gm portion contains approximately C 12, P 1, F 0 = 52 Cal

100 Grams	Approximate Household Measures
Apple juice, fr	½ gl or 3½ oz
Applesauce, cn, j p	½ c
Apricots, fr	2—1⅝" d
Apricots, cn, j p	2—1⅜" d
Apricots, cn, sieved, uns	½ c.
Cherries, sour, fr	½ c
Cherries, red or white, cn, j p	½ c
Crab apple juice, fr	½ gl or 3½ oz
Figs, cn, w p	4 sm
Grapefruit juice, cn, uns	½ gl or 3½ oz
Grapes, cn, w p	1 sm bunch or ⅔ c
Guavas, fr	½ c. or 10 med

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns.—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water-packed, j p—juice packed fr—fresh dr—dried sm—small lg—large

MISCELLANEOUS MEATS

	Amount in Grams	*Approximate Household Measures*	C	P	F
Bacon, crisp	15	3 strips—3¼" long	0	4	8
Beef, dr and smoked	20	⅓ c, diced, or 1 av serving	0	7	1
Bologna, all meat	60	2 slices—4½" d, ⅛" tk	0	8 6	10 7
Bologna, with added cereal	60	2 slices—4½" d, ⅛" tk	2.2	8 9	9 5
Braunschweiger	30	1 slice—3" d, ¼" tk	0	4 6	7 1
Frankfurter all meat	60	1 av	0	8 5	12 5
Frankfurter, with added cereal	60	1 av	2	9 1	8 5
Lamb chop, rib, lean, e p	60	1 sm. thin chop	0	10 6	9 4
Liver, raw	100	1 slice—3"x6"x⅛"	4	19	5
Luncheon meat	30	1 slice—¼" tk	0	4 8	7 1
Pork chop, lean, e p	60	1 sm. chop, med fat	0	20	15
Pork sausage, raw	60	1 patty—2" d., ⅓" tk.	0	6 5	27
Salami	60	2 slices—3¼" d, ¼" tk	0	14 3	22
Summer sausage, all types	60	2 slices—3¼" d, ⅛" tk	0	14 1	20 9
Veal chop med fat, e p	90	1 thin chop	0	17 3	9 9
Wieners, all meat	60	2 av	0	8 5	12.5
Wieners, with added cereal	60	2 av	2	9 1	8 5

FISH AND SEA FOODS

	Amount in Grams	*Approximate Household Measures*	C	P	F
Fish, cooked, broiled, or steamed,					
lean or med fat	100	1 piece—4"x2"x½"	0	21	2
fatter fish only	100	1 piece—4"x2"x½"	0	21	11
Oysters, fr	100	⅓ c, standard	6	10	2
Shrimp, cn	100	⅓ c.	1	18	1

SOYBEANS

	Amount in Grams	*Approximate Household Measures*	C	P	F
*Soybeans, fr, edible varieties, e p	100	⅔ c	6	12.5	6 5
*Soybeans, dr, edible varieties	100	½ c	12	34 9	18 1
*Soybeans, dr, edible varieties ck	100	½ c.	4	11 6	6 1

*Soybeans as marketed at present are really by products of the oil production process and contain only 5 to 6 percent of the original 20 percent (*J Am Diet A* 19 36, 1943)

OILS AND FATS

	Amount in Grams	*Approximate Household Measures*	C	P	F
Butter	10	1 pat or 2 t	0	0	8
Cooking fats	14	1 T	0	0	14
Mayonnaise	10	2 t.	0	0	8
Oleomargarine	10	1 pat or 2 t	0	0	8
Salad oils, pure	10	2 t	0	0	10

ABBREVIATIONS Gm.—Gram. C—Carbohydrate P—Protein F—Fat. T—Tablespoon. t—teaspoon. oz—ounces. c.—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns.—unsweetened gl.—glass. tom.—tomato jc—juice veg—vegetable. e p—edible portion. w p—water-packed. j p—juice-packed fr—fresh dr—dried sm—small. lg—large

MISCELLANEOUS GROUP (HIGH CARBOHYDRATE)

100 Grams	*Approximate Household Measures*	C	P	F
Apples, dr	½ c packed or 14 sm halves	73	1	1
Apricots, dr	¾ c packed or 16 sm halves	67	5	0
Banana, fr	1 med —6" long (e p)	23	1	0
Banana, dr	10 T	70	4	0
Beans, broad, dr	¾ c, shelled	58	25	2
Beans, Lima, fr	⅔ c., shelled	23	7	1
Beans Lima, dr	⅔ c	62	22	1
Beans, soy, dr seeds	½ c	12	35	18
Black eyed peas dr	½ c.	62	23	1
Cherries maraschino, cn	½ c	52	0	0
Corn, fr (med mature and old)	½ c or 1 med 8" ear	25	4	1
Corn, dr, sweet or field	½ c	71	11	3
Cowpeas, fr, green, shelled	⅔ c	23	9	1
Cowpeas dr	½ c	62	23	1
Currants, dr	¾ c.	71	2	0
Dates, fr	20 med	66	2	0
Dates, dr	15 med	66	2	0
Figs, dr	6 med	68	4	1
Lentils dr whole or split	½ c	60	24	1
Peaches dr	6—1¼" d	69	3	1
Pears, dr	5 med	72	2	0
Peas, fr (mature)	⅔ c, shelled	25	8	0
Peas, dr, whole or split	½ c	60	24	1
Persimmons, native, fr	2 sm	28	1	0
Plantain, or baking banana, fr	1 sm (e p)	33	1	0
Prunes, fr	4 med	20	1	0
Prunes, dr	12 med	60	2	1
Raisins dr	⅔ c	71	2	0
Sweet potato, fr	½ med	28	2	1
Sweet potato, cn	1 sm	31	1	0
Tomato catchup	7 T	24	2	0
Yam, winged, fr	1—4½"x1½"	24	2	0

MEAT AND POULTRY, COOKED

This approximate classification includes *cooked* beef, veal, lamb, chicken, turkey, rabbit, pork, and ham

	Amount in Grams	*Approximate Household Measures*	C	P	F
Meat and poultry, lean, med done	60	2 slices—3½"x2½"x¼"	0	18	4
Meat and poultry, med fat, med done	60	2 slices—3½"x2½"x¼"	0	16	11
Meat and poultry, fat med done	60	2 slices—3½"x2½"x¼"	0	13	18

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water-packed j p—juice-packed fr—fresh dr—dried sm—small lg—large

NUTS

	Amount in Grams	Approximate Household Measures	C	P	F
Almonds	10	9 to 10 nuts (e p)	2	1.9	5.4
Brazil nuts	30	4 to 5 nuts (e p)	3.3	4.3	19.8
Cashews	15	10 nuts (e p)	4	3	7
Chestnuts	35	7 to 8 nuts (e p)	14.5	0.4	0.2
Coconut, fr	35	1 slice—2"x2"x½" (e p)	4.9	1.1	12.1
Coconut, dr	20	2 T or ¼ c (e p)	10.6	0.7	7.8
Peanuts	30	25 nuts (e p)	7	8	13.3
Peanut butter	15	1 T	3	4	7.2
Pecans	15	4 to 5 nuts (e p)	2	1.4	11
Pistachios	15	15 nuts (e p)	2.8	2.9	8
Walnuts California, soft shell	15	9 halves (e p)	2.3	2.2	9.6
Walnuts, California, black	15	9 halves (e p)	2.8	2.7	8.7

MISCELLANEOUS

	Amount in Grams	Approximate Household Measures	C	P	F
*Beef juice	30	1 oz or 2 T	0	1.5	0
Beer, 4% alcohol	240	1 c or 8 oz	10	0	0
Bouillon cube	4	1	0	0.2	0.1
Catchup	25	1 T	6.6	0.5	0
Chili sauce	25	1 T	5.9	0.7	0
Chocolate, sweet	30	1 square	18	0.6	8.9
Chocolate, uns	30	1 square	5.4	1.6	15.9
Cocoa, dry, uns	8	1 T	2.5	0.7	1.5
Coca Cola	180	1 bottle	14.4	0	0
Corn syrup	30	2 T	22.2	0	0
Dextrose or glucose	30	2 T	29.9	0	0
Gelatin, granulated, dry	3	1 t	0	3	0
Ginger ale	200	1 gl	18	0	0
Honey, strained	30	1½ T	23.8	0	0
Jello, dry	5	1 t	4.4	0.5	0
Jelly	30	1⅔ T	19.5	0	0
Lactose	30	3 T	29.9	0	0
Mustard, prepared	15	1 T	0.5	0.6	1
Olives green	30	5 to 6	1.2	0.4	4
Olives, ripe	30	5 to 6	0.9	0.5	6
Pickles, sour	40	1 T, sliced	0.8	0.2	0
Popcorn, popped	25	1½ c	19.4	2.8	1.3
Sugar, cane or beet	30	2 T	29.9	0	0
Vinegar	15	1 T	0.[illegible]	0	0
Yeast, compressed	15	1 cake	2	2	0
*Yeast Fleischmann's	15	1 cake	1.2	2.1	0.1

*Bridges, M A *Dietetics for the Clinician*, Ed 5 Philadelphia Lea & Febiger 1949

ABBREVIATIONS Gm —Gram C—Carbohydrate P—Protein F—Fat. T —Tablespoon t —teaspoon. oz —ounces c —cup. cn —canned ck —cooked d —diameter av —average med —medium. tk. thick. uns —unsweetened gl —glass tom —tomato jc —juice veg —vegetable e p —edible portion w p water packed j p —juice-packed fr —fresh dr —dried sm.—small lg —large

CEREALS AND CEREAL PRODUCTS

	Amount in Grams	Approximate Household Measures	C	P	F
Bread, av	100	3⅓ av slices	50	8 9	2 4
Bread, av	30	1 av slice	15	3	1
Cereal, av, dry	100	13⅓ T, dry measure	75 9	10 7	2 3
e g oatmeal	20	2⅔ T dry, or scant ½ c ck	15	2	0
Cereal, prepared					
Bran flakes	15	½ scant c	10	1	0
Corn flakes	15	¾ c	11	2	0
Puffed rice	15	1 c	12 5	1	0 4
Puffed wheat	15	1 c	11 3	2	0 3
Rice Krispies	20	⅔ c	17 7	1 2	0
Shredded wheat	30	1 biscuit	24 5	2 3	0 3
Cracker graham	10	1 cracker	7 4	0 8	0 2
Cracker, saltine	8	1 double saltine	5 7	0 7	0 9
Cracker, soda	3	1—2" square	2 2	0 3	0 3
Hominy, ck	100	½ c	14 9	1 8	0 2
Macaroni, ck	100	½ c	19 4	3 7	0 4
Noodles, ck	100	½ c	19 4	3 7	0 4
Rice, ck	100	⅔ scant c	23 2	2 2	0 1
*Ry-Krisp	6	1 wafer	4 8	0 8	0 1
Spaghetti, ck	100	½ c	19 4	3 7	0 4
Zwieback	8	1—3¼"x1¼"x½"	5 9	0 9	0 7

*Analysis made by the manufacturer

DAIRY PRODUCTS

	Amount in Grams	Approximate Household Measures	C	P	F
Buttermilk genuine	200	1 gl	9 2	7	1
Buttermilk, artificial culture	200	1 gl	10	7	0 4
Cheese, American Cheddar	30	1 slice—3½"x2½"x⅜"	0 5	7 2	9 7
Cheese, cottage skim	30	2 T	1 3	5 7	0 2
Cheese, Philadelphia cream	30	⅓ package	0 3	3 4	11 3
Cheese, Swiss processed	30	1 slice—3"x3"x⅛"	0 5	7 1	7 8
Cream, coffee, 20% fat	30	1 oz or 2 T	1 2	0 9	6
Cream, whipping, 35% fat	30	1 oz or 2 T	1	0 7	11
Egg, white, e p	34	1 av	0 3	3 7	0
Egg, whole, e p	50	1 av	0 3	6 4	5 7
Egg, yolk, e p	16	1 av	0 1	2 6	5 1
Milk, evaporated	100	½ gl	10	7	8
Milk malted, powder	100	10 T	71	15	8
Milk, skim	200	1 gl	10	7	0 4
Milk, whole	200	1 gl	10	7	8

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water-packed j p—juice packed fr—fresh dr—dried sm—small lg—large

Food Equivalent Tables

Cereals—Approximate Equivalents of 10 Gm Cereal

C 8, P 1, F 1

	Amount in Grams	*Approximate Household Measures*
Cream of wheat	10	1 T uncooked or 1/4 c ck
Farina	10	1 T uncooked, or 3/4 c ck
Ralston	10	1 T uncooked or 3/4 c. ck.
Rice	6	2/3 T uncooked, or 1/3 c ck
Oatmeal	10	1 1/3 T uncooked or 3/4 c ck
Corn flakes	10	1/2 c
Puffed wheat	10	3/4 c
Puffed rice	10	1/2 c
Shredded wheat	10	1/3 lg biscuit
Rice krispies	10	1/2 c
40% Bran Flakes	10	1/4 c
Bread	15	1/2 slice
6% Fruit	130	See Group II list of fruits
9% Fruit	90	See Group III list of fruits
12% Fruit	70	See Group IV list of fruits
15% Fruit	55	See Group V list of fruits

Approximate Equivalents of 30 Gm Bread

C 15, P 3, F 1

	Amount in Grams	*Approximate Household Measures*
Cereal	20	2 times the amount of any of the cereals (see cereal list 10 Gm portions)
18% vegetable or 18% fruit	80	See Group VI vegetable or fruit list for equivalent measure
15% vegetable or 15% fruit	100	See Group V vegetable or fruit list for equivalent measure
12% vegetable or 12% fruit	125	See Group IV vegetable or fruit list for equivalent measure
9% vegetable or 9% fruit	170	See Group III vegetable or fruit list for equivalent measure
6% vegetable or 6% fruit	250	See Group II vegetable or fruit list for equivalent measure
Apricots, dr	25	4 sm halves
Banana	65	1/2 med
Dates dr	20	2
Figs, fr	75	2 1/2
Figs dr	20	1 1/2
Figs, cn , w p	100	3

ABBREVIATIONS Gm—Gram, C—Carbohydrate P—Protein. F—Fat. T—Tablespoon t—teaspoon oz—ounces. c—cup cn—canned ck.—cooked d—diameter av—average med—medium tk thick unr—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water packed. j p—juice-packed fr—fresh dr—dried sm—small lg—large

EQUIVALENTS AND SUBSTITUTES

Substitution of certain foods is necessary because of (1) inability to obtain the food listed in the menu, (2) dislike for that kind of food, (3) idiosyncrasy to the item listed (4) a desire to prevent monotony

The following lists of foods or combinations of foods are approximately equivalent in carbohydrate, protein, and fat content to some article that appears frequently in the menus

These equivalents are selected for their equality in carbohydrates, proteins, fats, and calories but not necessarily for equality in bulk or in vitamin and mineral content In making substitutions, therefore, care should be exercised that the diet does not become too low in vitamin and mineral content, or too concentrated in bulk In general bulky foods that is foods with low percentages of C, P, and F, can be measured with greater accuracy than more concentrated foods A given error in weighing a food containing 50 percent carbohydrate will be ten times as serious as the same error made in weighing a food containing 5 percent carbohydrate

Approximate Measure Equivalents of Fruits and Vegetables

100 Gm 3% (see Approximate Household Measures) = ½ approximate measure of 100 Gm 6% = ⅓ approximate measure of 100 Gm 9% = ¼ approximate measure of 100 Gm 12% = ⅕ approximate measure of 100 Gm 15% = ⅙ approximate measure of 100 Gm 18%

APPROXIMATE EQUIVALENTS OF FRUITS AND VEGETABLES

100 Gm	GROUP I 3%	GROUP II 6%	GROUP III 9%	GROUP IV 12%	GROUP V 15%	GROUP VI 18%
Group I 3%		50	34	25	20	18
Group II 6%	200		70	50	40	35
Group III 9%	300	150		75	60	50
Group IV 12%	400	200	130		80	70
Group V 15%	500	250	170	125		85
Group VI 18%	600	300	200	150	120	
Household measure specified	See approximate equivalents	½	⅓	¼	⅕	⅙

See lists of vegetables and fruits for approximate household measures

Approximate Equivalents of One Egg—*continued*
C 0, P 6, F 6

	Amount in Grams	*Approximate Household Measures*
Sardines cn in oil	20	2, each 3" long *plus* 5 Gm (1 t butter or fat
Oysters	60	3 med *plus* 6 Gm (1 full t) butter or fat
Crab meat	40	½ scant c flaked *plus* 5 Gm (1 t) butter or fat
Shrimp cn or ck	40	3 to 5 or ½ c *plus* 8 Gm (1½ t) butter or fat
Bacon crisp	25	5 strips—3¼" long *minus* 30 Gm (2 T butter or fat
Peanuts roasted	22	22 to 23 no skins *minus* 5 Gm (1 t) butter or fat and *minus* 45 Gm 12% fruit (see Group IV list of fruits)
Peanut butter	23	1½ T *minus* 6 Gm (1 full t butter or fat and *minus* 40 Gm 12% fruit (see Group IV list of fruits)
Walnuts black	33	18 halves *minus* 16 Gm (1 full T butter or fat and *minus* 50 Gm 12% fruit see Group IV list of fruits)
Walnuts English	40	24 halves or 3½ T chopped *minus* 5 Gm (1⅓ T) butter or fat and *minus* 50 Gm 12% fruit (see Group IV list of fruits)
Cashews	30	16 to 20 med *minus* 17 Gm 3 ½ t) butter or fat and *minus* 65 Gm fruit see Group IV list of fruits)

Approximate Equivalents of 30 Gm Cooked Lean Meat
C 0, P 9, F 2

	Amount in Grams	*Approximate Household Measure*
Beef veal, or lamb lean ck	30	1 thin slice—3½"x2½"x¼"
Lamb chop lean	60	1 thin *minus* 8 Gm (1½ t) butter
Pork chop lean	30	½ sm *minus* 5 Gm (1 t butter
Veal chop lean	30	1 sm
Pork fr or smoked ham lean	30	1 thin slice—2½"x1½"x¼"
Chicken turkey rabbit fowl (roast lean)	30	1 slice—3½"x2½"x¼"
Sausage fat cooked out	30	1½—each 3" long x ½ " d
Bologna	30	2 slices—2½" d ½ thick *minus* 10 Gm t) butter
Wieners	60	2
Frankfurter	60	1 *minus* 10 Gm (2 t) butter
Liver raw	50	1 slice—3"x3"x½"
Heart	30	1 slice—2"x1"x½"
Sweetbreads	30	1 piece—2½"x1"x¾" or ¼ c

ABBREVIATIONS Gm —Gram C—Carbohydrate P—Protein. F—Fat T —Tablespoon t—teaspoon oz.—ounces. c —cup cn —canned. ck —cooked d —diameter av —average med medium tk thick uns—unsweetened gl —glass. tom —tomato jc —juice veg —vegetable e p —edible portion w p water-packed j p —juice-packed fr —fresh. dr —dried sm —small lg —large

Approximate Equivalents of 30 Gm. Bread—*continued*
C 15, P 3, F 1

	Amount in Grams	*Approximate Household Measures*
Peaches, dr	21	3 halves
Pears, dr	21	1¼ halves
Prunes, dr	25	2 med
Prunes, fr	70	2¾ med (e p)
Raisins, seeded or seedless	21	1 scant T
Beans, dr (navy, kidney, pinto, Lima, dr peas, and others)	25	⅙ c dr, or ½ scant c. ck
Lima beans, fr	60	⅓ c or 2½ T
Lentils, dr, whole and split	25	⅛ scant c dr, or ½ scant c ck
Sweet potato	55	1½ full T, or ½ sm (e p)
Tomato catchup	60	3 T
Crackers, soda	20	6⅓
Saltines	20	2½—4″x2″
Ry-Krisp	19	3 wafers
Crackers, Ritz	25	7
Rice, ck	70	½ c
Macaroni, ck, or plain noodles	80	⅓ c.
Potato chips	30	20 lg pieces, *minus* 12 Gm (2½ t) butter or fat

Approximate Equivalents of One Egg
C 0, P 6, F 6

	Amount in Grams	*Approximate Household Measures*
Cheese, American	20	1 slice—3¼″x2½″x⅛″
Cheese, Philadelphia cream	60	⅔ pkg, *minus* 19 Gm (4 t) butter or fat
Cheese, Swiss	30	1½ slices—3¼″x2½″x⅛″, *minus* 3 Gm. (½ t) butter or fat
Cheese, cottage, creamed	30	2 T, *plus* 5 Gm (1 t) butter or fat
Milk	180	1 gl (6 oz), *minus* 75 Gm 12% fruit (see Group IV list of fruits)
Meat, lean	20	⅔ oz, *plus* 5 Gm (1 t) butter (see list of meats)
Fish, fr, baked or broiled	30	1 slice—2″x2″x½″, or 1 oz, *plus* 3 Gm. (½ t.) butter or fat
Fish, boiled or steamed	30	1 slice—2″x2″x½″, or 1 oz, lean or med fat, *plus* 6 Gm (1 full t) butter or fat
Fish, boiled or steamed	30	1 slice—2″x2″x½″, or 1 oz, fatter fish only, *plus* 3 Gm (½ t) butter or fat
Tuna fish, cn, with or without added oil	30	⅙ c flaked, or 1 piece—1″x1″x1″, or 1 oz, *plus* 4 Gm (1 scant t) butter or fat
Salmon, cn	30	¼ scant c flaked, or 1 oz., *plus* 4 Gm. (1 scant t.) butter or fat

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon. oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med.—medium tk—thick. uns—unsweetened gl.—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water-packed, j p—juice-packed fr—fresh dr—dried sm.—small lg—large

Approximate Equivalents of 30 Gm American Cheese
C 0, P 7, F 10

	Amount in Grams	Approximate Household Measures
Egg	50	1 *plus* 5 Gm (1 t) butter or fat
Cheese Philadelphia cream	30	½ pkg *plus* 1 egg (9 Gm) or 2 scant t butter
Cheese Swiss	30	1½ slices—3½"x2½"x⅛" *plus* 3 Gm [illegible] t butter or fat
Cheese cottage creamed	35	2⅓ T *plus* 10 Gm (2 t) butter or fat
Meat lean	25	⅚ oz *plus* 10 Gm (2 t) butter or fat
Fish baked or broiled	30	1 slice—2"x2"x½" or 1 oz *plus* 8 Gm 1½ t butter or fat
Fish boiled or steamed lean or med fat	30	1 slice—2"x2"x½" or 1 oz *plus* 11 Gm [illegible] t butter or fat
Fish, boiled or steamed fatter fish only	30	1 slice—2"x2"x½ or 1 oz *plus* 9 Gm [illegible] scant t) butter or fat
Fish tuna cn with or without added oil	30	⅙ scant c flaked or 1 piece 1 x1 x1 [illegible] oz *plus* 9 Gm (2 scant t) butter or fat
Salmon cn	35	¼ c. flaked or 1⅙ oz *plus* 9 Gm [illegible] butter or fat
Sardines cn in oil	30	3 each 3" long *plus* 9 Gm 2 scant t [illegible] fat
Oysters	70	3½ med *plus* 11 Gm (2 full t [illegible]
Crab meat	45	¼ c flaked *plus* 11 Gm (full t [illegible]
Shrimp ck or cn	40	3 to 5 or ⅓ c *plus* 12 Gm 2 [illegible] bu[illegible] or fa[illegible]
Bacon crisp	30	6 strips—3¼" long *minus* 7 Gm [illegible] bu[illegible] or fat
Peanuts, roasted	35	37 to 38 nuts no skins *minus* 6 Gm [illegible] butter or fat
Peanut butter	28	2 scant T *minus* 5 Gm (1 t butter or fa[illegible]
Walnuts black	40	21 halves *minus* 16 Gm [illegible]
Walnuts English	45	24 to 30 halves or 3¼ T chopped *minus* [illegible] Gm (4½ t) butter or fat
Nuts, cashew	35	18 to 20 med *minus* 8 Gm [illegible]

Approximate Equivalents of 40 Gm American Cheese
C 0, P 9, F 12

	Amount in Grams	Approximate Household Measures
Meat lean	30	1 oz *plus* 12 Gm (2½ t) butter or fat [illegible] equivalents of 30 Gm of meat
Egg	75	1½ *minus* 4 Gm (1 scant t butter or fat or 1 [illegible] times the equivalents of 1 egg

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T Tablespoon [illegible] oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium [illegible] uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p [illegible] packed j p—juice-packed f—fresh dr—dried sm—small lg large

Approximate Equivalents of 30 Gm. Cooked Lean Meat—*continued*

C 0, P 9, F 2

	Amount in Grams	*Approximate Household Measures*
Bacon, crisp	36	7 strips—3½" long, *minus* 22 Gm (1½ T) butter or fat
Beef, dr	27	5 slices—3½"x7½", or ⅓ c diced
Beef, corned, cn, med fat	36	1 slice—3½"x3"x¼", or 1¼ oz, *minus* 3 Gm (½ t) butter or fat
Beef, corned, fr, lean	50	1⅓ slices—3½"x3"x¼", *minus* 5 Gm (1 t.) butter or fat
Eggs	75	1½, *minus* 9 Gm (2 scant t) butter or fat
Cheese, American	40	2 slices—3½"x2½"x¼", *minus* 12 Gm (2½ t) butter or fat
Cheese, Philadelphia cream	90	1 pkg, 3 oz, *minus* 38 Gm (2 T and 1½ t) butter or fat
Cheese, cottage, creamed	45	3 level T
Cheese, Swiss	40	1 slice—3½"x3½"x¼", *minus* 10 Gm (2 t) butter or fat
Fish, fr, baked or broiled	40	1 slice—2"x3"x½", *minus* 4 Gm (1 scant t) butter or fat
Fish, steamed or boiled, lean or med fat	40	1 slice—2"x3"x½"
Fish, boiled or steamed, fatter fish only	40	1 slice—2"x3"x½", *minus* 4 Gm. (1 scant t) butter or fat
Tuna fish, cn, with or without added oil	40	⅓ c flaked, *minus* 6 Gm (1 full t) butter or fat
Salmon, cn	45	⅓ c flaked, or 1½ oz, *minus* 3 Gm (½ t) butter or fat
Sardines, cn in oil	35	3½, each 3" long, *minus* 3 Gm. (½ t) butter or fat
Oysters	90	4 to 5 med.
Crab meat	55	⅓ c flaked
Shrimp, ck or cn	50	4 to 7, *plus* 3 Gm (½ t.) butter or fat
Peanuts, roasted	33	33 to 34, no skins, *minus* 15 Gm (1 T) butter or fat, *minus* 75 Gm 12% fruit (see Group IV list of fruits)
Peanut butter	34	2½ T, *minus* 17 Gm (3½ t) butter or fat, *minus* 60 Gm 12% fruit (see Group IV list of fruits)

Approximate Equivalents of 20 Gm. American Cheese

C 0, P 5, F 6

Equal approximately one egg or any of the equivalents of one egg

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat. T—Tablespoon t.—teaspoon. oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick. uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable e p—edible portion w p—water-packed j p—juice-packed fr—fresh dr—dried sm—small lg—large

100 Gm * Group I Vegetable or Fruit (3%)
Are Approximately Equivalent to

35 Gm	9% vegetable or fruit (Group III)
50 Gm	6% vegetable or fruit (Group II)

100 Gm * Group II Vegetable or Fruit (6%)
Are Approximately Equivalent to

35 Gm	18% vegetable or fruit (Group VI)
40 Gm	15% vegetable or fruit (Group V)
50 Gm	12% vegetable or fruit (Group IV)
70 Gm	9% vegetable or fruit (Group III)
200 Gm	3% vegetable or fruit (Group I)

100 Gm * Group III Vegetable or Fruit (9%)
Are Approximately Equivalent to

50 Gm.	18% vegetable or fruit (Group VI)
60 Gm	15% vegetable or fruit (Group V)
75 Gm	12% vegetable or fruit (Group IV)
150 Gm.	6% vegetable or fruit (Group II)
300 Gm	3% vegetable or fruit (Group I)

100 Gm * Group IV Vegetable or Fruit (12%)
Are Approximately Equivalent to

70 Gm	18% vegetable or fruit (Group VI)
80 Gm	15% vegetable or fruit (Group V)
130 Gm	9% vegetable or fruit (Group III)
200 Gm	6% vegetable or fruit (Group II)
400 Gm	3% vegetable or fruit (Group I)

100 Gm * Group V Vegetable or Fruit (15%)
Are Approximately Equivalent to

85 Gm	18% vegetable or fruit (Group VI)
125 Gm	12% vegetable or fruit (Group IV)
170 Gm	9% vegetable or fruit (Group III)
250 Gm	6% vegetable or fruit (Group II)
500 Gm.	3% vegetable or fruit (Group I)

100 Gm * Group VI Vegetable or Fruit (18%)
Are Approximately Equivalent to

120 Gm	15% vegetable or fruit (Group V)
150 Gm	12% vegetable or fruit (Group IV)
200 Gm.	9% vegetable or fruit (Group III)
300 Gm	6% vegetable or fruit (Group II)
600 Gm	3% vegetable or fruit (Group I)

*See lists of vegetables and fruits for approximate household measures.

Approximate Equivalents of 200 Gm Milk
C 10, P 7, F 8

	Amount in Grams	*Approximate Household Measures*
Egg	50	1 *plus* 85 Gm 12% fruit (see Group IV list of fruits) *plus* 3 Gm ($\frac{1}{2}$ t) butter or fat
Milk skim	200	$6\frac{2}{3}$ oz, *plus* 10 Gm (2 t) butter or fat
Bacon crisp	28	$5\frac{1}{2}$ strips—$3\frac{1}{4}''$ long *minus* 9 Gm. (2 scant t) butter or fat *plus* 85 Gm 12% fruit (see Group IV list of fruits)
Cheese American	30	$1\frac{1}{2}$ slices—$3\frac{1}{4}''$x$2\frac{1}{4}''$x$\frac{1}{8}''$ *minus* 3 Gm ($\frac{1}{2}$ t) butter or fat *plus* 85 Gm 12% fruit (see Group IV list of fruits)
Cheese cottage creamed	36	$2\frac{1}{4}$ T *plus* 10 Gm (2 t) butter or fat *plus* 85 Gm 12% fruit (see Group IV list of fruits)

Approximate Equivalents of 10 Gm Bacon
C 0, P 2, F 5

	Amount in Grams	*Approximate Household Measures*
Egg	20	$\frac{1}{3}$ *plus* 4 Gm (1 scant t) butter or fat
Cream coffee	30	2 T
Cheese American	10	1 slice—$3\frac{1}{4}''$×$1''$x$\frac{1}{8}''$ *plus* 3 Gm ($\frac{1}{2}$ t) butter or fat

One-third of any of the equivalents of one egg

Approximate Equivalents of 30 Gm Coffee Cream
C 1, P 1, F 6

	Amount in Grams	*Approximate Household Measures*
Milk	30	2 T *plus* 6 Gm (1 full t) butter or fat
Bacon crisp	5	1 strip—$3\frac{1}{4}''$ long *plus* 4 Gm (1 scant t) butter or fat

Approximate Equivalents of 50 Gm Coffee Cream
C 2, P 1, F 10

	Amount in Grams	*Approximate Household Measures*
Milk	50	$1\frac{2}{3}$ oz or $3\frac{1}{3}$ T *plus* 10 Gm (2 t) butter or fat
Bacon	5	1 strip—$3\frac{1}{4}''$ long *plus* one soda cracker *plus* 10 Gm (2 t) butter or fat

ABBREVIATIONS Gm—Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz—ounces c—cup cn—canned ck—cooked d—diameter av—average med—medium tk—thick uns—unsweetened gl—glass tom—tomato jc—juice veg—vegetable ep—edible portion wp—water-packed jp—juice-packed fr—fresh dr—dried sm—small lg—large

Ice Cream

Ingredients	*Amount in Grams*	*Approximate Measure*
Egg	50	1
Milk, whole	270	1⅛ gl or 9 oz
Milk, evaporated	240	1 1/5 gl or 8 oz
Cream, top or coffee	600	3 gl or 20 oz
Saccharin	0 14	9—¼-grain tablets
Gelatin, Knox pure	12	2⅓ level t
Vanilla	10	2 t
Salt	2 5	½ t

Beat all ingredients together well, except the gelatin Soak the gelatin in a little cold water and then thoroughly dissolve it in a little hot water Add the gelatin solution to the other mixture very slowly while beating constantly Strain out any small lumps Freeze in a refrigerator or in an ice and salt pack, stirring often until the mixture is of the consistency of mush Measure out in 3½-oz paper soufflé cups (80 Gm. or ⅓ cup each) while the mixture is still soft Store in the freezing compartment of the refrigerator

Use one serving or 80 Gm in place of

⅓ gl or 3⅓ oz milk plus 2 t or 10 Gm of butter or fat

Food value per serving C 5, P 4, F 8

Custard

Ingredients	*Amount in Grams*	*Approximate Measure*
Egg	50	1
Milk, whole	180	1 scant gl
Saccharin	0 03	2—¼ grain tablets
Salt		sm pinch
Vanilla		few drops

Beat all ingredients together well and pour into two custard cups or a small pan Place in a pan of cool water and bake in a slow oven for about ½ hour, or until a thin knife blade comes out clean when inserted into the custard This recipe makes two average servings of about 100 Gm each

One serving may be used in place of

1 One egg and ⅓ av slice of bread (10 Gm), or
2 One half egg and ½ gl or 3⅓ oz (100 Gm) milk

Food value per serving C 4 5, P 6, F 6 5

Note This custard mixture may be cooked in a water bath until it coats the spoon and be served as soft custard Also, this soft custard may be frozen and served as ice cream

ABBREVIATIONS Gm —Gram C—Carbohydrate P—Protein F—Fat T—Tablespoon t—teaspoon oz —ounces c —cup cn —canned ck —cooked d —diameter av —average med —medium tk —thick uns —unsweetened gl —glass tom —tomato jc —juice veg —vegetable e p —edible portion w p —water-packed j p —juice-packed fr —fresh dr —dried sm —small lg —large

ing test only Arbitrary levels have been established so that all blood-sugar values above these levels will give positive (colorless) tests and all blood-sugar values below these levels will give negative (blue) tests The test is accurate within ± 5 mg percent Because of this variation, it is perhaps more accurate to interpret the results when using the 130 mg percent screening level tablet (Reagent No 3A) in this manner If the test is negative (blue), the blood sugar level is below 130 mg percent If the test is positive (colorless), the blood sugar level is above 120 mg percent

When the 180 mg percent screening level tablet (Reagent No 3B) is used, a negative test indicates a blood sugar level below 180 mg percent, and a positive test indicates that the blood-sugar level is above 170 mg percent

The mechanics of the test utilize a true blood glucose method consequently diagnostic levels are somewhat lower than those considered for other blood-sugar methods

On occasion it may be necessary to test at a hypoglycemic level The test kit can be adapted to screen at a 50 mg percent level if the following steps are carried out

1 Fill the test tube with tap water or distilled water to the mark

2 Collect 0 2 cc of blood (use both pipettes)

3 Add two Reagent Tablets No 1751 (Reagent No 1) and two Reagent Tablets No 1752 (Reagent No 2)

4 Boil, using two Reagent Tablets No 1756 Methenamine, for Timed Burning, and remove protein cake

NORMAL HEIGHT—WEIGHT ½ TO 21 YEARS*

AGE	MALE		FEMALE		AGE	MALE		FEMALE	
Years	Height Inches	Weight Pounds	Height Inches	Weight Pounds	Years	Height Inches	Weight Pounds	Height Inches	Weight Pounds
½	26	17	26	16	11	55	75	55	74
1	29	21	29	20	12	57	81	57	87
2	33	26	33	25	13	59	90	60	94
3	36	31	36	30	14	62	103	62	105
4	39	35	39	34	15	64	112	63	112
5	42	38	41	37	16	66	126	64	117
6	45	43	44	43	17	67	133	64	122
7	47	50	47	47	18	68	135	65	124
8	49	55	49	54	19	69	138	65	126
9	51	61	51	60	20	69	139	65	126
10	53	67	53	67					

*Reproduced by courtesy of J H BARACH, M D —Director Falk Clinic University of Pittsburgh

Acetone—Sodium Nitroprusside Test

REAGENTS

1 Dry, finely powdered sodium nitroprusside, 5 Gm, mixed with 200 Gm of ammonium sulfate, is much more convenient and stable than the solutions usually employed

2 *Strong ammonia water*

To test, add enough of the above nitroprusside mixture to saturate 2 to 3 cc of urine in a test tube, and shake well Overlay with a small quantity of strong ammonia water A positive test is indicated by a color ranging from faint purplish pink to dark purple, reaching its maximum intensity within a few minutes, then fading gradually to a muddy brown The reaction of a faint trace of acetone may be most easily determined by noting the purple track of the ammonia water through the white foam If acetoacetic acid is present, it intensifies the test Absence of color reaction *may be noted in specimens which show a color reaction in the* Gerhardt test due to drugs

Acetoacetic Acid—Gerhardt's Test

REAGENT 10 percent aqueous solution of ferric chloride

To test, add a 10 percent ferric chloride solution drop by drop to 3 to 5 cc of urine in the test tube until no more precipitate forms The depth of Burgundy red color which appears indicates the presence of acetoacetic acid Acetoacetic acid is unstable on boiling Divide the specimen into two tubes, boil one and then compare If the color was due to acetoacetic acid, it will disappear on boiling If due to a drug it remains Any specimen giving a red test which does not fade on boiling should be examined in addition by the sodium nitroprusside test in order to detect acetone which is masked by "drug reaction"

THE URINE SUGAR TEST CASE, SHEFTEL

When the test is to be performed, place in the test tube a measured quantity of tap water, add to it a measured volume of the urine to be tested, and in this place one Copper Sulfate Compound Tablet Then place a standard Methenamine Tablet for Timed Burning at a measured distance below the bottom of the test tube set the case in such a position that no drafts will blow the flame away from the test tube and light the Methenamine Tablet By finding which shade on the color chart is most nearly matched by the resulting contents of the test tube, one can estimate closely the percentage of sugar

WILKERSON-HEFTMANN TEST KIT

It should be remembered that the blood-sugar test described herein is a screen-

ing test only Arbitrary levels have been established so that all blood-sugar values above these levels will give positive (colorless) tests and all blood-sugar values below these levels will give negative (blue) tests The test is accurate within ±5 mg percent Because of this variation, it is perhaps more accurate to interpret the results when using the 130 mg percent screening-level tablet (Reagent No 3A) in this manner If the test is negative (blue), the blood-sugar level is below 130 mg percent If the test is positive (colorless), the blood-sugar level is above 120 mg percent

When the 180 mg percent screening level tablet (Reagent No 3B) is used, a negative test indicates a blood-sugar level below 180 mg percent, and a positive test indicates that the blood sugar level is above 170 mg percent

The mechanics of the test utilize a true blood-glucose method, consequently, diagnostic levels are somewhat lower than those considered for other blood-sugar methods

On occasion, it may be necessary to test at a hypoglycemic level The test kit can be adapted to screen at a 50 mg percent level if the following steps are *carried out*

1 Fill the test tube with tap water or distilled water to the mark

2 Collect 0 2 cc of blood (use both pipettes)

3 *Add two Reagent Tablets No 1751 (Reagent No 1) and two Reagent* Tablets No 1752 (Reagent No 2)

4 Boil, using two Reagent Tablets No 1756, Methenamine, for Timed Burning, and remove protein cake

NORMAL HEIGHT—WEIGHT ½ TO 21 YEARS*

AGE	MALE		FEMALE		AGE	MALE		FEMALE	
Years	Height Inches	Weight Pounds	Height Inches	Weight Pounds	Years	Height Inches	Weight Pounds	Height Inches	Weight Pounds
½	26	17	26	16	11	55	75	55	74
1	29	21	29	20	12	57	81	57	82
2	33	26	33	25	13	59	90	60	94
3	36	31	36	30	14	62	103	62	105
4	39	35	39	34	15	64	112	63	112
5	42	38	41	37	16	66	126	64	117
6	45	43	44	43	17	67	133	64	122
7	47	50	47	47	18	68	138	65	124
8	49	55	49	54	19	69	139	65	126
9	51	61	51	60	20	69	139	65	126
10	53	67	53	67					

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5 Add one Reagent Tablet No 1753 (Reagent No 3A), supplement the heating with a third Reagent Tablet No 1756, Methenamine, for Timed Burning

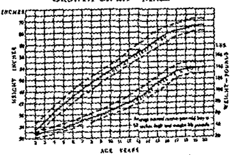
6 At the end of the second heating period, immerse the tube in cold water and add two Reagent Tablets No 1755 (Reagent No 4)

"Ideal" Weights for Men—Ages 25 and Over | "Ideal" Weights for Women—Ages 25 and Over

(from Metropolitan Life Insurance Co)

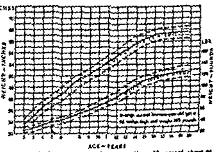
Height (with shoes)		Weight in Pounds (as ordinarily dressed)			Height (with shoes)		Weight in Pounds (as ordinarily dressed)		
		Small Frame	Medium Frame	Large Frame			Small Frame	Medium Frame	Large Frame
Feet	Inches				Feet	Inches			
5	2	116–125	124–133	131–142	4	11	104–111	110 118	117–127
5	3	119–128	127–136	133–144	5	0	105–113	112–120	119 129
5	4	122–132	130–140	137–149	5	1	107–115	114–122	121–131
5	5	126–136	134–144	141–153	5	2	110–118	117–125	124–135
5	6	129–139	137–147	145–157	5	3	113–121	120–128	127–138
5	7	133–143	141–151	149 162	5	4	116–125	124–132	131–142
5	8	136–147	145–156	153–166	5	5	119–128	127–135	133–145
5	9	140–151	149–160	157–170	5	6	123–132	130–140	138–150
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Growth Chart—Male*



Solid lines indicate average normals broken lines 10 percent above or below ideal normals.

Growth Chart—Female*



Solid lines indicate average normals broken lines, 10 percent above or below ideal normals.

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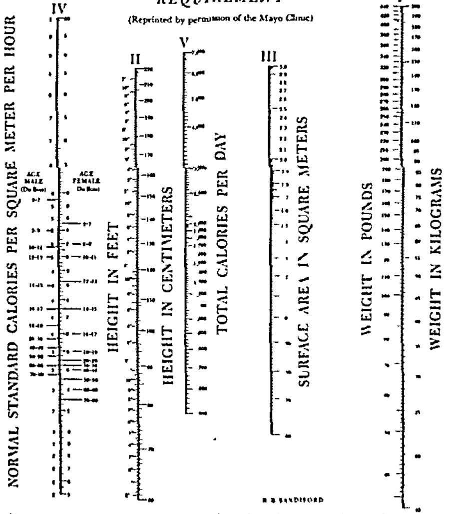
CHART FOR DETERMINATION OF BASAL CALORIC REQUIREMENT



Place the chart on a flat, smooth table. Use only a ruler with a true straight edge. Do not draw lines on the chart but merely indicate their positions by the straight edge of the ruler. Locate the various points by means of needles (pin stuck through the eraser of a lead pencil). Locate the patient's normal weight on Scale I and his height on Scale II. The ruler joining these two points intersects Scale III at the patient's surface area. Locate the age and sex of the patient on Scale IV. A ruler joining this point with the patient's surface area on Scale III crosses Scale V at the basal caloric requirement. For the maintenance requirement 30 to 50 percent of the figure then obtained is added to that figure.

5 Add one Reagent Tablet No 1753 (Reagent No 3A); supplement the heating with a third Reagent Tablet No 1756, Methenamine, for Timed Burning

6 At the end of the second heating period, immerse the tube in cold water and add two Reagent Tablets No 1755 (Reagent No 4).

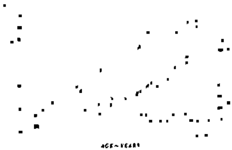
"Ideal" Weights for Men—Ages 25 and Over

"Ideal" Weights for Women—Ages 25 and Over

(from Metropolitan Life Insurance Co)

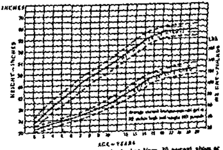
Height (with shoes)		Weight in Pounds (as ordinarily dressed)			Height (with shoes)		Weight in Pounds (as ordinarily dressed)		
		Small Frame	Medium Frame	Large Frame			Small Frame	Medium Frame	Large Frame
Feet	Inches				Feet	Inches			
5	2	116–125	124–133	131–142	4	11	104–111	110–118	117–127
5	3	119–128	127–136	133–144	5	0	105–113	112–120	119–129
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	3	168–180	176–189	184–202	6	0	141–153	151–163	160–174

Growth Chart—Male*



Solid lines indicate average normals broken lines, 10 percent above or below ideal normals.

Growth Chart—Female*

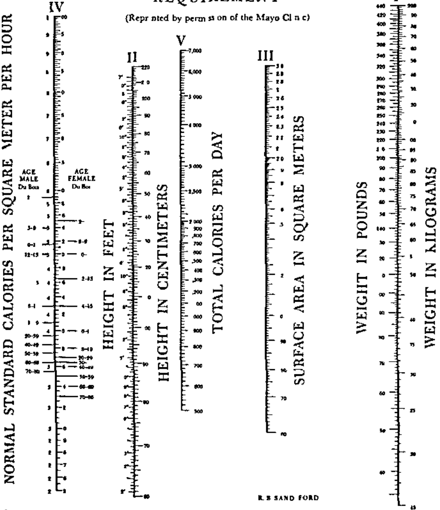


Solid lines indicate average normals broken lines, 10 percent above or below ideal normals.

*Reproduced by courtesy of J H Barach, M.D—Director, Falk Clinic, University of Pittsburgh

CHART FOR DETERMINATION OF BASAL CALORIC REQUIREMENT

(Repr nted by perm ss on of the Mayo Cl n c)



Place the chart on a flat smooth table Use only a ruler w th a true stra ght edge Do not draw l nes on the chart but merely nd cate the r pos t ons by the stra ght edge of the ruler Locate the various po nts by means of needles (p n stuck through the eraser of a lead penc l) Locate the pat ent s normal we ght on Scale I and h s he ght on Scale II The ruler jo n ng these two

5 Add one Reagent Tablet No 1753 (Reagent No 3A), *supplement the* heating with a third Reagent Tablet No 1756, Methenamine, *for Timed Burning*

6 At the end of the second heating period, immerse the tube in cold water and add two Reagent Tablets No 1755 (Reagent No 4)

IDEAL WEIGHTS FOR MEN—AGES 25 AND OVER ' IDEAL ' WEIGHTS FOR WOMEN—AGES 25 AND OVER

(from Metropolitan Life Insurance Co)

Height (with shoes)		Weight in Pounds (as ordinarily dressed)			Height (with shoes)		Weight in Pounds (as ordinarily dressed)		
Feet	Inches	Small Frame	Medium Frame	Large Frame	Feet	Inches	Small Frame	Medium Frame	Large Frame
5									
5									
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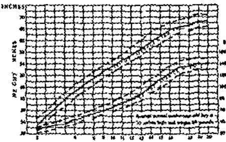
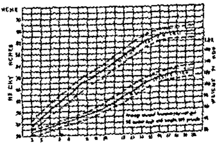
6	(								
6	1								
6									
6	3	168–180	176–189	184–202	6	0	141–153	151–163	160–174

GROWTH CHART—MALE*



Solid lines indicate average normals broken lines, 10 percent above or below ideal normals.

GROWTH CHART—FEMALE*



Solid lines indicate average normals broken lines, 10 percent above or below ideal normals.

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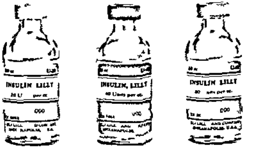
INSULIN

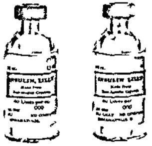
LILLY

PREPARATIONS

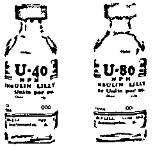
Short Action
Insulin Lilly



Short Action
Insulin Lilly made from zinc Insulin crystals



Prolonged Action
NPH Insulin Lilly



Prolonged Action
Protamine Zinc Insulin Lilly

Insulin Lilly Preparations

How Supplied

Insulin, Lilly, is supplied in 10-cc vials, designated U-20, U-40, U-80, and U-100, and containing 20, 40, 80, and 100 units per cc, respectively. The U-20 and U-40 concentrations are also supplied in 5-cc vials.

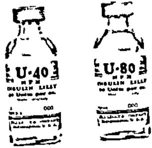
Insulin, Lilly, made from zinc-Insulin crystals *is supplied in 10-cc vials, designated U-40 and U-80 and containing 40 and 80 units per cc,* respectively.

NPH Insulin, *Lilly, is supplied in 10-cc* "rounded square" vials, designated U-40 and U-80, and containing 40 and 80 units per cc, respectively.

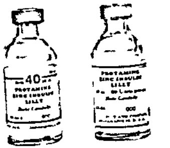
Protamine Zinc Insulin, *Lilly, is supplied in* 10-cc vials containing 400 and 800 units, and labeled 40 and 80 units per cc, respectively.

Short Action
Insulin, Lilly

Short Action
Insulin, Lilly, made from zinc-Insulin crystals



Prolonged Action
NPH Insulin, Lilly



Prolonged Action
Protamine Zinc Insulin
Lilly

SECTION 7

Recent Publications of Interest on NPH Insulin

ARDUINO, F O Uso da Insulina no Diabetes, Arq clín, *12* 95, 1951

ARDUINO, F, and VIEIRA DE SILVA, M C Estudo Clínico Preliminar com a Insulina NPH 50, Rev brasil med, *8* 1, 1951

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ITURBE ZABALETA, I, RODRÍGUEZ ARGUELLES, J, and PALACIOS BERMUDEZ R Estudio Comparativo entre la Insulina NPH y la Mezcla 2 1 de Insulina Regular con Insulina Protaminozíncica Rev méd d Hosp españ, *1* 29, 1951

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Recent Publications of Interest on NPH Insulin

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[illegible] Insulin NPH 50

[illegible] Benno Schwabe &

[illegible] MULHOLLAND [illegible] with New Types of Insulin Virginia M Monthly, *78* 190 1951

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